December 8, 1958

Aviation Week

Including Space Technology

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Pilot Report On Bell's Turbine HU-1 Iroquois

Boeing B-52 Drops McDonnell Quail Decoy

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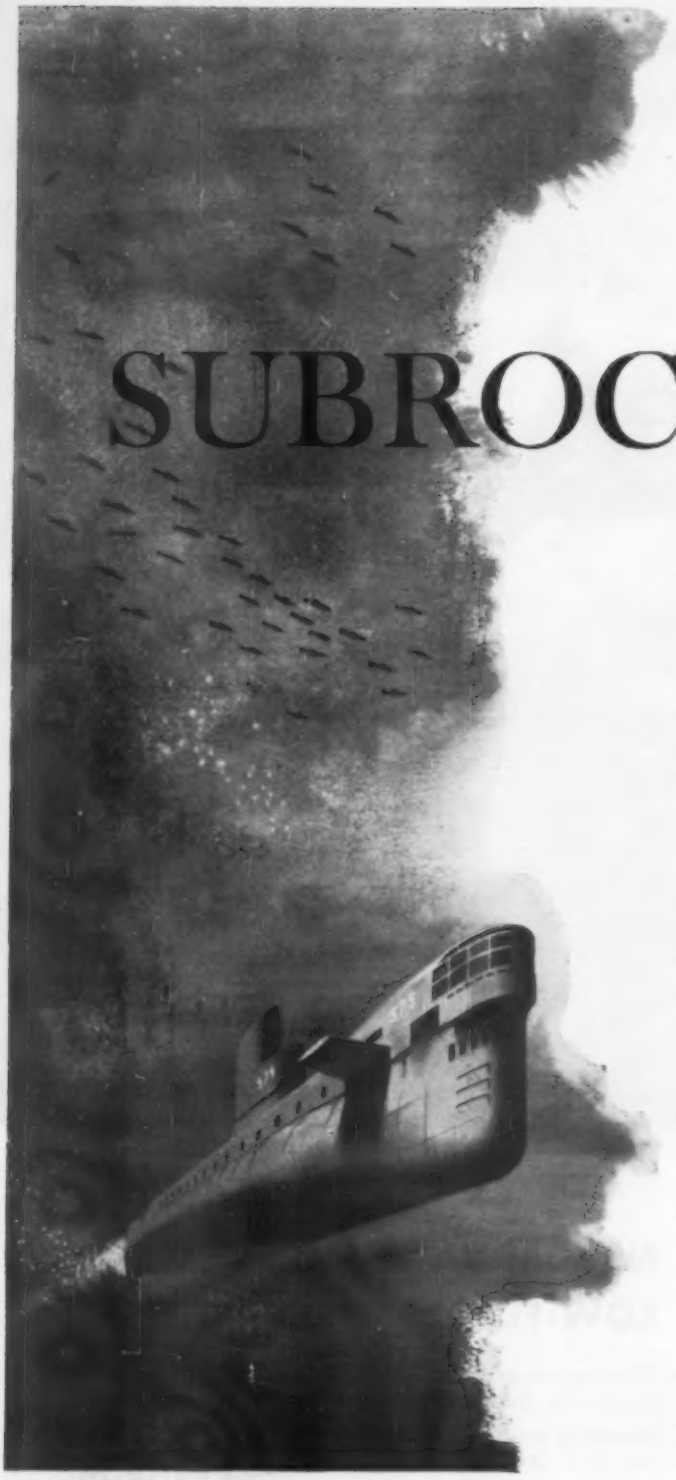

SUBROC

– new antisubmarine weapon system—will seek, strike and destroy lurking submarines at long range. Spearheaded by an underwater guided missile which can be fired from below the surface, this vital system – now being developed for the Navy's Bureau of Ordnance, under the technical direction of the Naval Ordnance Laboratory in Silver Spring, Md. – will use our existing underwater fleet as launching platforms.

Development of Subroc is the responsibility of Goodyear Aircraft Corporation, producer of Pinpoint* Guidance, nose cones, rocket engine cases and major components in virtually every area of the nation's most advanced weapon systems.

WEAPON SYSTEMS—a prime capability of

GOODYEAR AIRCRAFT

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*T. M. Goodyear Aircraft Corp., Akron, Ohio

STRIKE OF THE HAWK!

RAYTHEON-DESIGNED HAWK missile annihilates radio-controlled F-80 jet fighter at 500 ft. altitude.

ARMY'S HAWK MISSILE is fired from mobile launcher. Missiles, launcher and support equipment can be air-lifted or quickly transported by Army or Marine ground forces.

NEW ARMY MISSILE DESTROYS LOW-FLYING AIRCRAFT

This *proven* anti-aircraft missile operates even at tree-top heights, in the blind zone of other radar-controlled missiles.

Raytheon is prime contractor for the U.S. Army Hawk weapon system—now in production and slated for use with fast-moving Army and Marine Corps ground forces as well as for the defense of U. S. cities.

RAYTHEON

Excellence in Electronics

RAYTHEON MANUFACTURING COMPANY, Waltham, Mass.

AVIATION CALENDAR

Dec. 17—22nd Wright Brothers Lecture, Maurice Roy on French aeronautical research, Natural History Bldg., Smithsonian Institution, Washington, D. C.

Dec. 27-30—Fifth Annual Meeting, American Astronautical Society, Hotel Statler, Washington, D. C. Meeting will be held in conjunction with the 125th Annual Meeting of the American Assn. for the Advancement of Science.

Dec. 27-30—Fifth King Orange International Model Plane Meet, Miami, Fla.

Jan. 12-14—Fifth National Symposium on Reliability and Quality Control in Electronics, Bellevue-Statler Hotel, Philadelphia, Pa.

Jan. 13-14—Symposium on Cathode Ray Tube Recording, sponsored by Systems Development Corp., Engineers Club, Dayton, Ohio.

Jan. 19-21—11th Annual Convention, Helicopter Assn. of America, Villa Hotel, San Mateo, Calif.

Jan. 21-23—South West Electronic Exhibit, Arizona State Fairgrounds, Phoenix, Ariz.

Jan. 26-29—27th Annual Meeting, Institute of the Aeronautical Sciences, Sheraton-Astor Hotel, New York, N. Y. Honors Night Dinner, Jan. 27.

Jan. 27-29—Fifth Annual Radar Symposium (classified), Rockham Bldg., University of Michigan, Ann Arbor, Mich.

Jan. 27-30—15th Annual Technical Conference, Society of Plastics Engineers, Hotel Commodore, New York, N. Y.

Jan. 28-29—Fifth Annual Midwest Welding Conference, sponsored by Armour Research Foundation, Illinois Institute of Technology, Chicago, Ill.

Feb. 3-5—14th Annual Technical and Management Conference, Reinforced Plastics Division, Society of the Plastics Industry, Inc., Edgewater Beach Hotel, Chicago.

Feb. 12-13—1959 Solid State Circuits Con-

(*Continued on page 6*)

AVIATION WEEK Including Space Technology

December 8, 1958
Vol. 69, No. 23

Published weekly with an additional issue in December by McGraw-Hill Publishing Company. James H. McGraw (1860-1948), Founder. See panel below for directions regarding subscription or change of address. **Executive, Editorial, Circulation and Advertising Offices: McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y.** Publication Office, 99-129 North Broadway, Albany 1, N. Y. Donald C. McGraw, President; Joseph A. Gerardi, Executive Vice President; L. Keith Goodrich, Vice President and Treasurer; John J. Cooke, Secretary. Officers of the Publications Division: Nelson L. Bond, President; Harry L. Waddell, Senior Vice President; Ralph B. Smith, Vice President and Editorial Director; Joseph H. Allen, Vice President and Director of Advertising Sales; A. R. Venezian, Vice President and Circulation Coordinator.

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Single copies 75¢. Subscription rates—United States and possessions, $7 one year. Canada $8 one year. All other countries, $20 one year.

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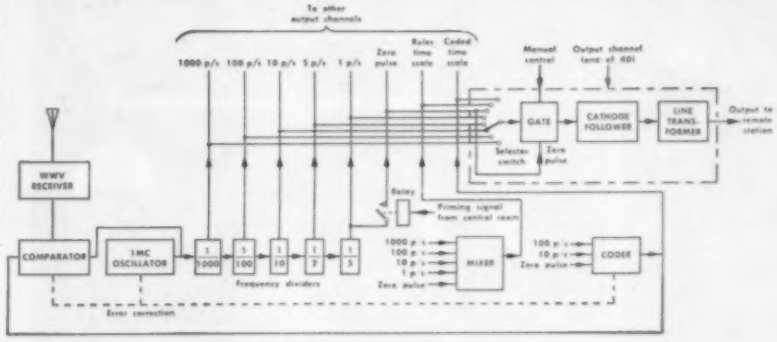
AN INTEGRATED TIMING SYSTEM FOR TRACKING AND CONTROL OF MISSILES



Schematic diagram of Central Timing Station

The Hycon Eastern Integrated Timing System, when used as a central station timer, meets the requirements of most range instrumentation with one comprehensive unit. At pre-programed times during the shoot, time markers are supplied to recording instruments and switching pulses are supplied to recording and control instruments located in remote slave stations.

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Solar or sidereal time is displayed visually and is available for both input to automatic computers and as an index to data being recorded during the test run. Capable of operating anywhere in the world, this system is also suited for astronomical measurements and navigation systems. Write for Bulletin TS-00.

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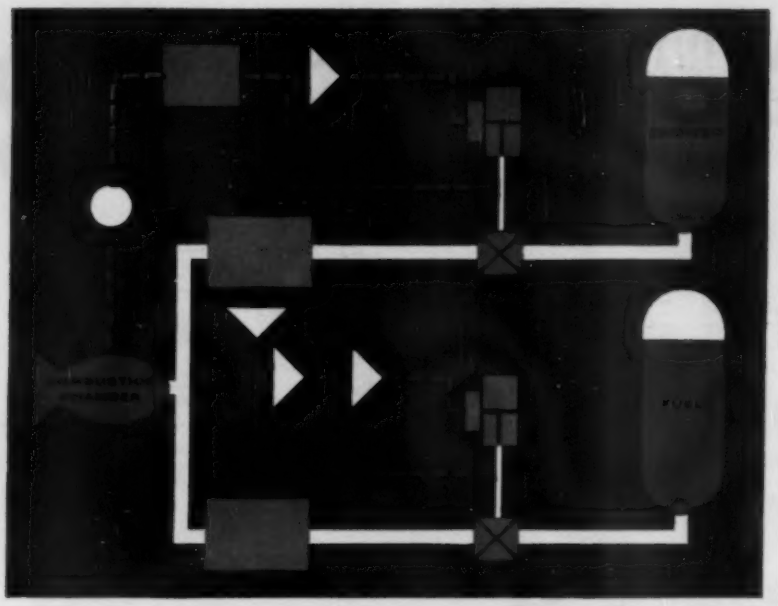

In static rocket engine testing . . . CompuDyne Control Systems give greater scope and more useful data

The ability to handle severe transients and to program rocket engine testing on a dynamic basis has made the CompuDyne Rocket Fuel Control System extremely important today.

Oxidizers and high-energy fuels are accurately proportioned and fed to the combustion chamber under precisely controlled flow-pressure conditions.

Steady-state controllability is within close limits but, more important, broad programming within a single run is now practical. Stabilization time between programmed set points may be less than one second. Errors are fully predictable.

The advantages of this complete, packaged system are simple enough: more data faster; more test points per run, more runs per day . . . and with greater accuracy. Ullage volume requirements are minimized and start-up is appreciably simplified.

Similar techniques and a well-founded knowledge of cryogenic materials are used to test rocket engine accessories such as turbo pumps, gas generators and valves.

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AVIATION CALENDAR

(*Continued from page 5*)

ference, sponsored by Institute of Radio Engineers' Professional Group on Circuit Theory, American Institute of Electrical Engineers' Committee on Electronics and University of Pennsylvania, Philadelphia.

Feb. 21-22—13th Annual Pacific Coast Mid-Winter Soaring Championships, Torrey Pines Gliderport, San Diego, Calif.

Feb. 26-March 1—1959 Engineering Exposition, Balboa Park, San Diego, Calif. Address inquiries to: 422 Land Title Bldg., San Diego 1, Calif.

March 3-5—1959 Western Joint Computer Conference, sponsored by Institute of Radio Engineers, American Institute of Electrical Engineers and Assn. for Computing Machinery, Fairmont Hotel, San Francisco, Calif.

March 5-6—Flight Propulsion Meeting (classified), Institute of the Aeronautical Sciences, Hotel Carter, Cleveland, Ohio.

March 5-7—Western Space Age Conference and Exhibit. For information: Domestic Trade Dept., Los Angeles Chamber of Commerce, 404 South Bixel St., Los Angeles 54, Calif.

March 8-11—Engineering meeting on the turbine in action, sponsored by Gas Turbine Division of the American Society of Mechanical Engineers, Cincinnati, Ohio.

March 16-20—11th Western Metal Exposition and Congress, American Society for Metals, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles, Calif.

March 23-26—National Convention, Institute of Radio Engineers, Coliseum and Waldorf-Astoria Hotel, New York, N. Y.

March 31-Apr. 2—Polytechnic Institute of Brooklyn's Ninth International Symposium. Subject: Millimeter Waves. Auditorium, Engineering Societies Bldg., New York, N. Y. Cosponsors: Department of Defense Research Agencies and Institute of Radio Engineers.

March 31-Apr. 3—National Aeronautic Meeting, Society of Automotive Engineers, Hotel Commodore, New York, N. Y.

Apr. 5-10—1959 Nuclear Congress. Municipal Auditorium, Cleveland, Ohio. For information: Engineers Joint Council, 29 West 39th St., New York 18, N. Y.

Apr. 7-10—1959 Welding Show and 40th Annual Convention, American Welding Society, International Amphitheatre and Hotel Sherman, Chicago, Ill.

Apr. 12-19—Air Force Assn.'s World Congress of Flight, Las Vegas, Nev.

May 4-6—National Aeronautical Electronics Conference, Institute of Radio Engineers, Biltmore Hotel, Dayton, Ohio.

May 4-7—Fifth Annual Flight Test Instrumentation Symposium, sponsored by the Instrument Society of America, Seattle Section, Olympic Hotel, Seattle, Wash.

May 6-8—1959 Electronic Components Conference, Benjamin Franklin Hotel, Philadelphia, Pa. Sponsors: Institute of Radio Engineers, Electronic Industries Assn., American Institute of Electrical Engineers, West Coast Electronic Manufacturers Assn.

May 20-22—Second Jet Age Airport Conference, American Society of Civil Engineers, Shamrock-Hilton Hotel, Houston, Tex.

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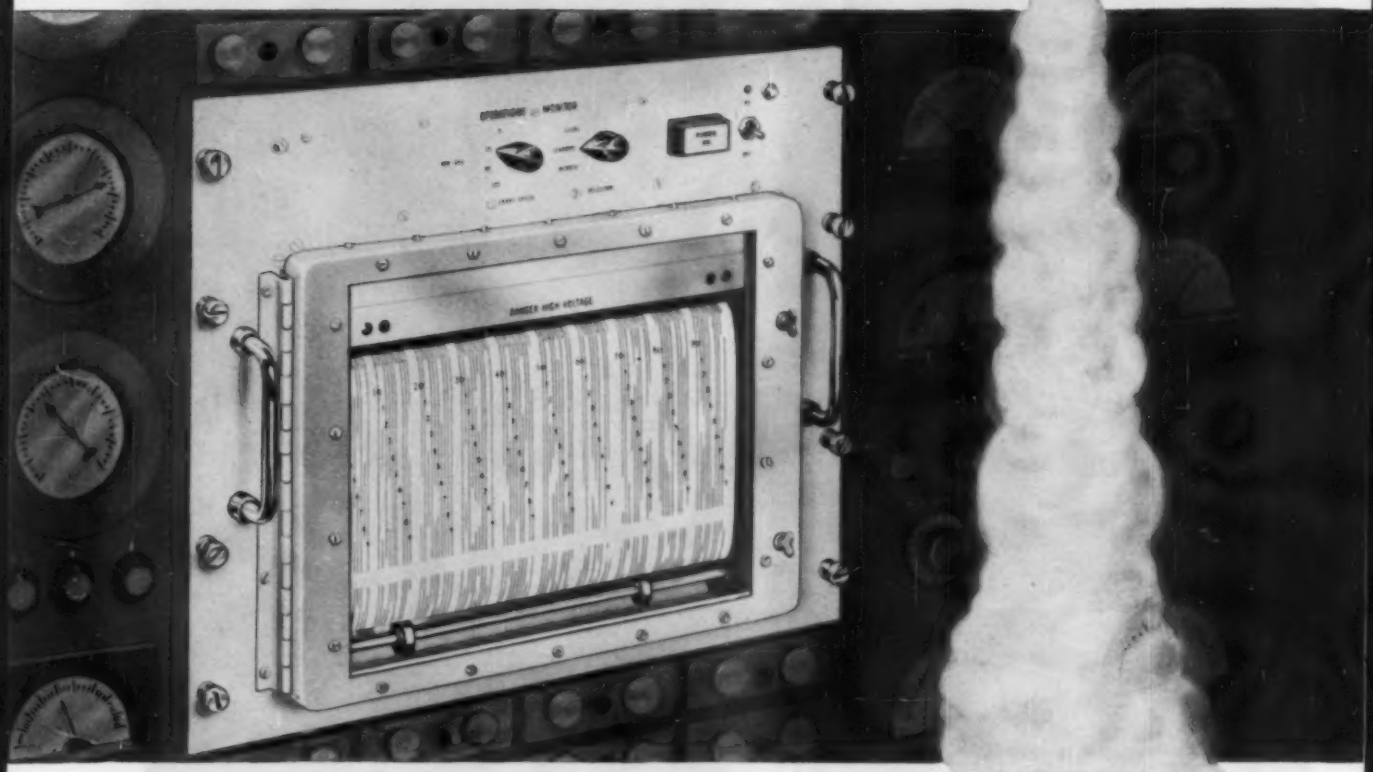

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THE MAN BEHIND THE GREASEGUN . . . The exploits of the fliers and aircraft that are keeping our nation secure can not be written without proper credit to the unheralded man behind the greasegun. He is a member of a maintenance crew . . . a crew chief . . . a plane captain who is content to enjoy the reflected glory of his ship. Something of him flies with every aircraft, and when ship and crew return safely he knows his job has been well done. For he knows that nothing could fly, no pilot could climb aboard without his contribution. Kaman Aircraft recognizes the job these men are doing and gives them a tangible salute by designing helicopters which require minimum maintenance and make the man behind the greasegun whistle while he works.

PIONEERS IN TURBINE POWERED HELICOPTERS

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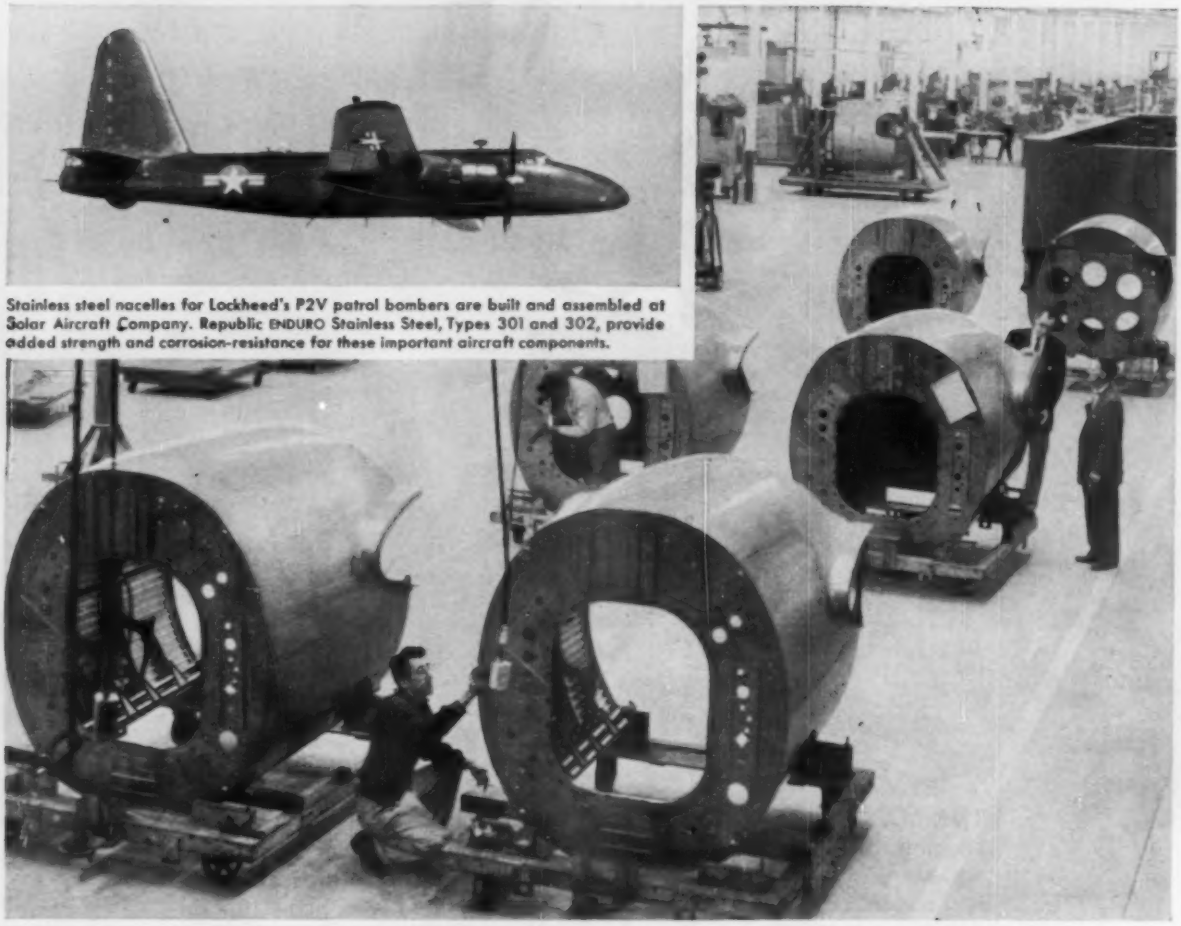


Stainless steel nacelles for Lockheed's P2V patrol bombers are built and assembled at Solar Aircraft Company. Republic ENDURO Stainless Steel, Types 301 and 302, provide added strength and corrosion-resistance for these important aircraft components.

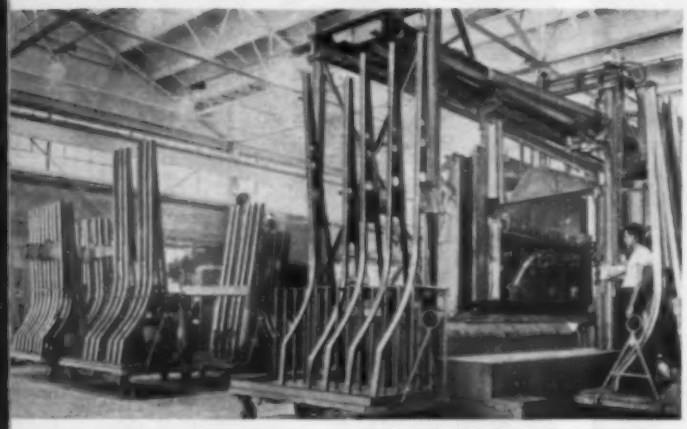
REPUBLIC ENDURO® STAINLESS STEEL HELPS SOLVE strength, heat, and corrosion problems in engine nacelles for the Navy's P2V patrol bombers.

Complete nacelles are built by Solar Aircraft Company, San Diego, California, pioneers in stainless steel airframe construction. To date, Solar has manufactured more than 1000 nacelles for Lockheed's P2V program using A.I.S.I. Types 301 and 302 Stainless Steel.

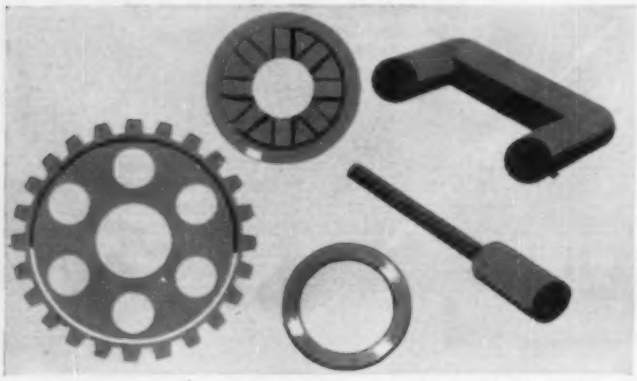
The stainless steel construction of these airframe units offers a number of advantages including greater strength, ability to withstand high temperatures, less maintenance for protection against corrosion and more economical production processes.

Republic ENDURO Stainless Steels, Types 301 and 302, provide needed strength, yet permit the use of lighter gages to save weight. They are highly resistant to atmospheric corrosion, erosion, and oxidation at high temperatures. They are readily formed into desired shapes by the usual commercial methods.

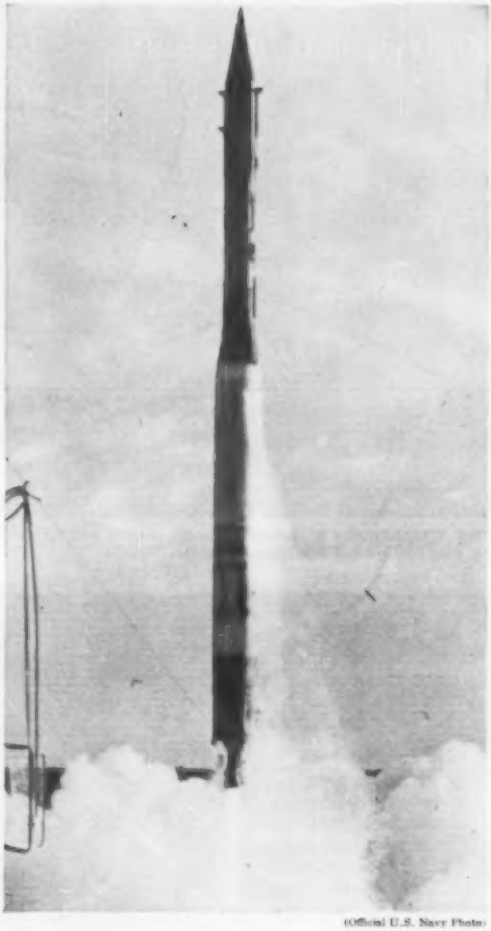
Like Solar, Republic is also a stainless steel pioneer. Republic metallurgists and engineers pioneered the development of these high strength-to-weight, heat-resistant, and corrosion-resistant metals. To help you use them to best advantage, Republic offers you the services of its famed 3-Dimension Metallurgical teams —field, mill, and laboratory metallurgists. The coupon is your invitation to use this confidential and obligation-free service.



ALLOY STEEL WELDMENTS meet high strength, precision requirements in USAF bombers. The weldment technique, developed by Rohr Aircraft Corporation, Chula Vista, California, is currently being used in the manufacture of flap tracks for an Air Force Bomber program. The material used is AMS 6428 Alloy Steel, a type supplied by Republic. This fine steel provides a minimum tensile strength of 180,000 psi in the heat treated condition. Uniform response to heat treatment assures exceptionally good deep hardening characteristics—plus hard-wear-resistant surfaces. Specify Republic Alloy Steel for your parts that must be tough, strong, dependable. Our metallurgists will help you. Send coupon for facts.



REPUBLIC DEVELOPS NEW POWDER for structural, electrical, and electronic part applications. Type MS is a soft, higher purity powder with excellent carbon compatibility. It can be used for comparable strength structural parts at lower cost than obtainable with copper. It is also ideally suited for use in fabricating pole pieces, permanent magnets, cores, armatures, etc. MS Powder can be used to fabricate larger parts on normal pressing equipment. Mail coupon for complete details on physical properties, chemical composition, test evaluations.



(Official U.S. Navy Photo)

TITANIUM FOR WEIGHT REDUCTION in the Navy's Vanguard. Because of its weight saving and high strength factors, titanium is currently being used for many applications in both missiles and aircraft. In missiles and rockets it has almost unlimited applications. Titanium's extremely high corrosion-resistance makes it attractive for tanks to hold acids used in combination with missile fuels. Nitric acid, for example, has negligible effect on titanium. It is practically immune to salt water and sea air corrosion. Republic produces titanium in all commercial forms. Republic metallurgists will help you apply titanium to best advantage. Send coupon for more facts.

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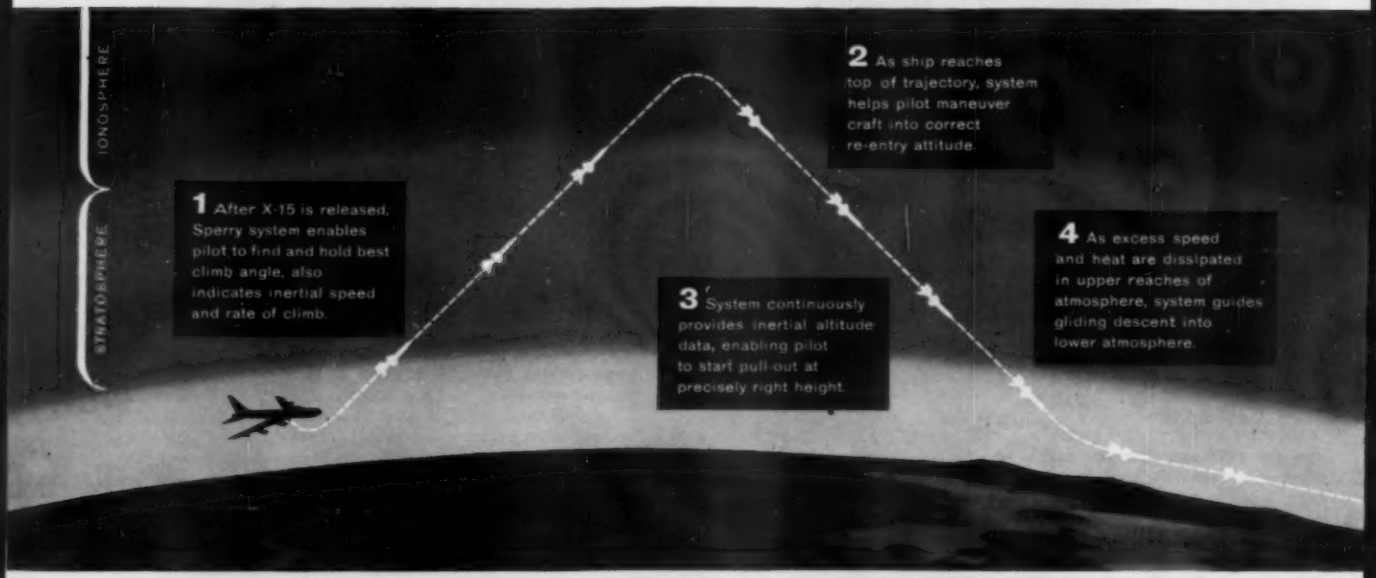
HYPERSONIC X-15, powered by a mighty rocket engine, will follow bullet-like trajectory during flight, similar to path of ballistic missile.

WEARING SPECIALLY-DESIGNED SPACE SUIT, X-15 pilot is protected against environmental extremes as he maneuvers the rocket to the edge of space.


IONOSPHERE
STRATOSPHERE
1 After X-15 is released, Sperry system enables pilot to find and hold best climb angle, also indicates inertial speed and rate of climb.
2 As ship reaches top of trajectory, system helps pilot maneuver craft into correct re-entry attitude.
3 System continuously provides inertial altitude data, enabling pilot to start pull-out at precisely right height.
4 As excess speed and heat are dissipated in upper reaches of atmosphere, system guides gliding descent into lower atmosphere.

X-15 WILL THRUST 100 MILES INTO SPACE UNDER CONTROL OF NEW INERTIAL SYSTEM

Strapped firmly into his cockpit, an Air Force pilot soon will ride the North American X-15 rocket research ship 100 miles and more into the sky at speeds above 3600 mph—over a mile a second.

A highly advanced Sperry inertial system, developed in conjunction with the Flight Control Laboratory of Wright Air Development Center, will supply control data for this historic venture. When the pilot and his revolutionary craft drop from a B-52 jet bomber, the inertial system will give him data for maneuvering and navigating the X-15 with extreme accuracy. As the stainless steel research plane flashes outward through the thinning atmosphere, the Sperry system will "show" the pilot how to correct for even the smallest deviation from flight path. It will display flight information on specially developed instruments; at the same time feeding the data to ground and airborne recorders for a permanent record of the flight.

An important additional contribution of the Sperry system will be to guide the pilot in bringing the X-15 safely back into the earth's atmosphere. During this critical phase of the flight, attitude of the X-15 on re-entry must be precisely controlled to avoid exceeding its structural limitations.

On this daring journey into space, the super-sensitive Sperry system will have to function perfectly under conditions ranging from extreme acceleration to complete weightlessness, through temperature swings that may heat the X-15's exterior to 1,000 degrees in a few seconds.

SPERRY GYROSCOPE COMPANY
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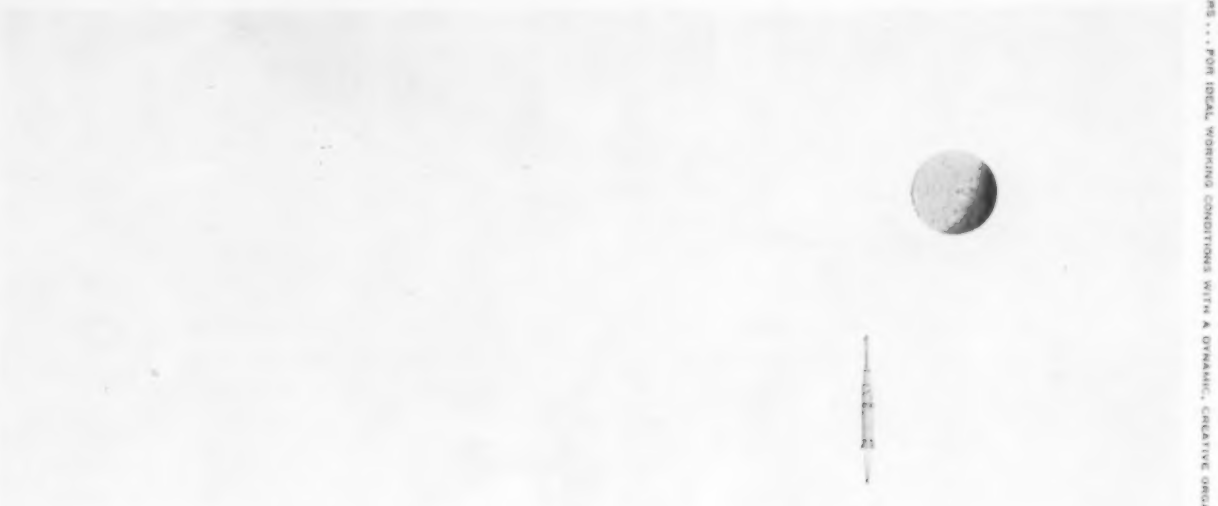
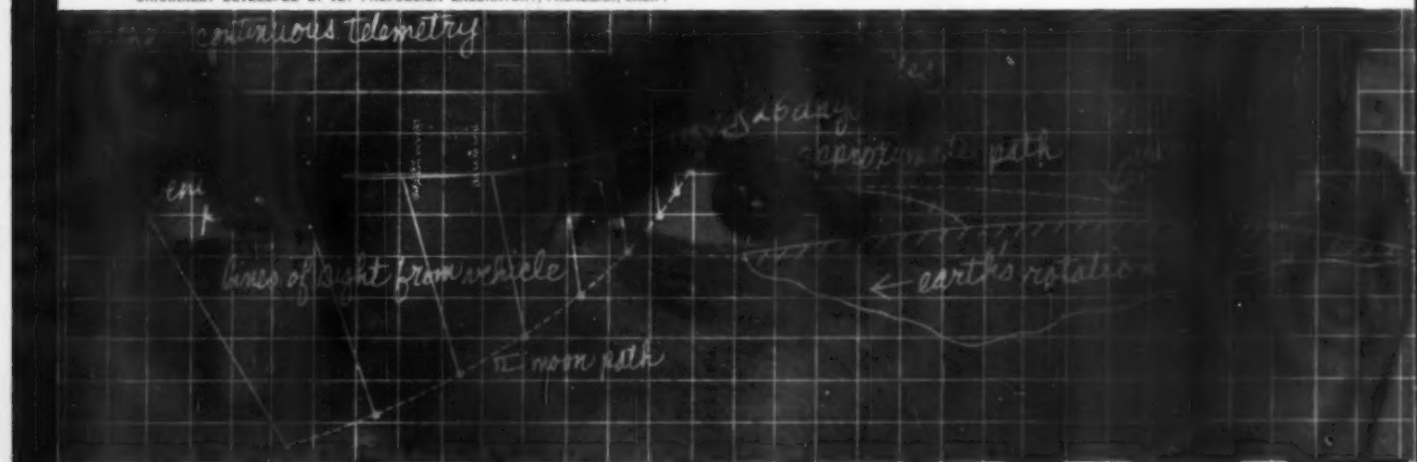


INTELLIGENCE—Hallamore Microlock* provides the all-important link of intelligible communication between space vehicles and earth. Six Hallamore developed Microlock tracking stations monitor positions and receive intelligence from Vanguard and Explorer satellites...stand watch, with full capability, on U.S. Airforce and U.S. Army Lunar Probes. Microlock "locks" on fractional signals from tiny transmitters to bring in messages free of noise distortion. Hallamore developments in audio-visual telemetry, versatile automatic checkout systems, and guidance are speeding man's mastery of missilry and space technology. For systems capability, plug-in building blocks and C.C.T.V., write Hallamore Electronics Company, 8352 Brookhurst Avenue, Anaheim, California / TWX: AH 9079: a division of The Siegler Corporation.

*ORIGINALLY DEVELOPED BY JET PROPULSION LABORATORY, PASADENA, CALIF.



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Time on the ground costs money between touchdown and take-off. Any aviation product which can cut "ramp time", cuts an airline's operating costs. Sinclair Aircraft Oils have earned the reputation for prolonging engine life – cutting maintenance. Proof of this is the fact that *45% of the oil used by major scheduled airlines in the U.S. is supplied by Sinclair.* Isn't it time you, too, cut your cost of operation by using Sinclair Aircraft Oil?

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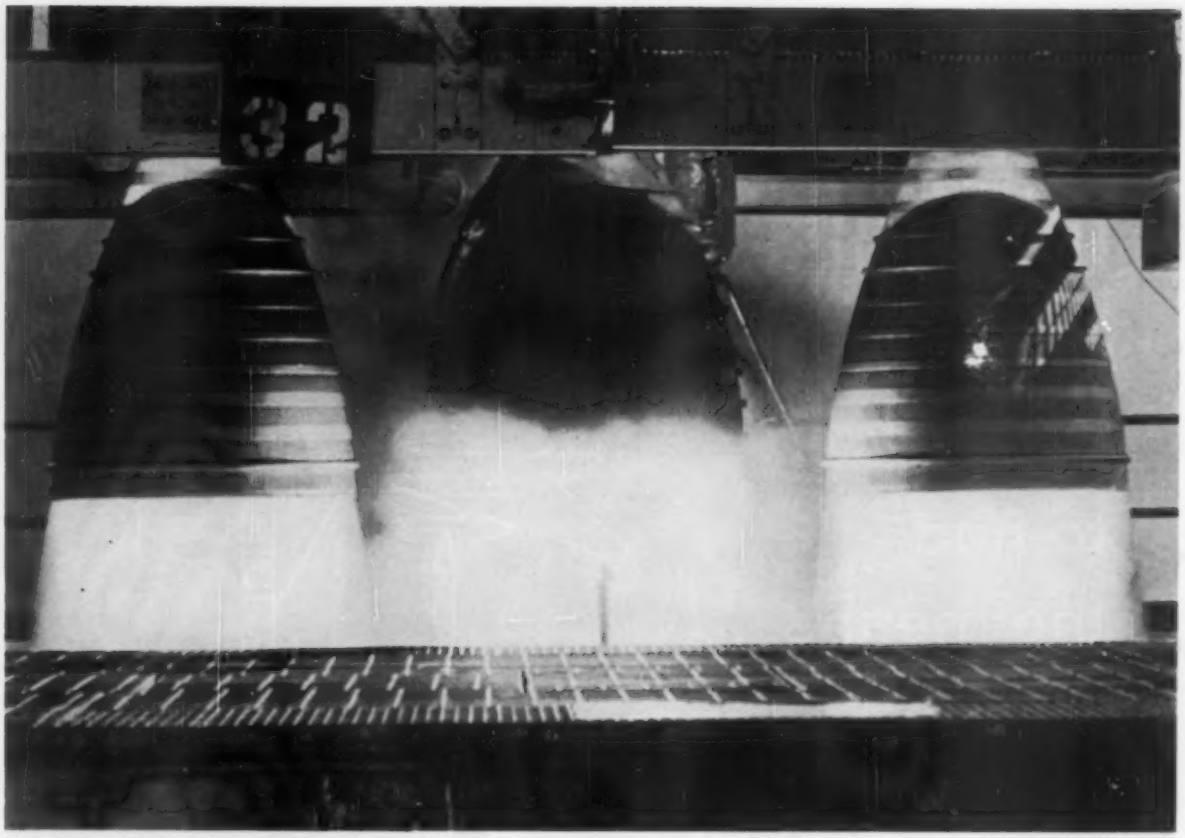

Special Solar skills for advanced missile systems

Powerful Rocketdyne booster engine chambers—designed to withstand combustion temperatures of 5500 F—are being fabricated by Solar. The chambers are an outstanding example of Solar's advanced technology in the missile systems field. Made from hundreds of spaghetti-like nickel or stainless steel tubes, they are precision fabricated and brazed together to form nozzles. A large sustainer engine plus the twin-chambered booster engine make up the liquid propellant power system for the giant Atlas ICBM.

Solar's leadership in high-temperature technology—*plus advanced facilities*—is one part of the company's outstanding missile and weapon systems capability. Complete engineering, research and test facilities—staffed by a team of systems engineers participating in America's most challenging missile and space programs—are available to help solve your difficult design, development and production problems. Write for details to Dept. F-96, Solar Aircraft Company, San Diego 12, California.

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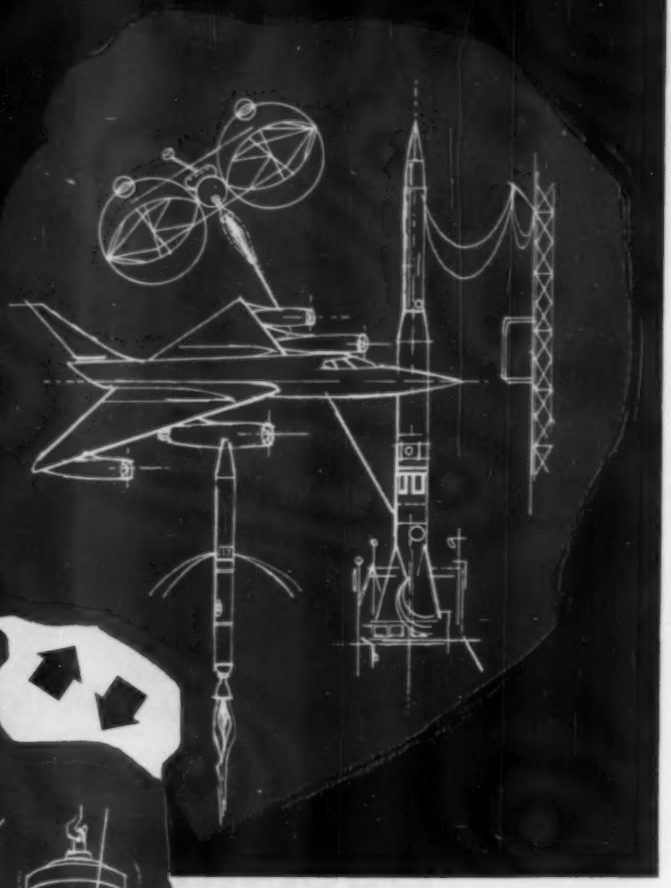

Recent contributions of the Aeronautical Division of A. O. Smith include assignments in research and/or production for the Atlas, Polaris, Jupiter, Nike-Zeus and Vanguard projects. A. O. Smith has also helped pioneer heat exchanger design for nuclear seaborne vessels.

A. O. Smith Aeronautical Division continues to demonstrate unique capabilities to work with research and development groups in government agencies and prime and sub contractors in the airframe, propulsion and missile fields.

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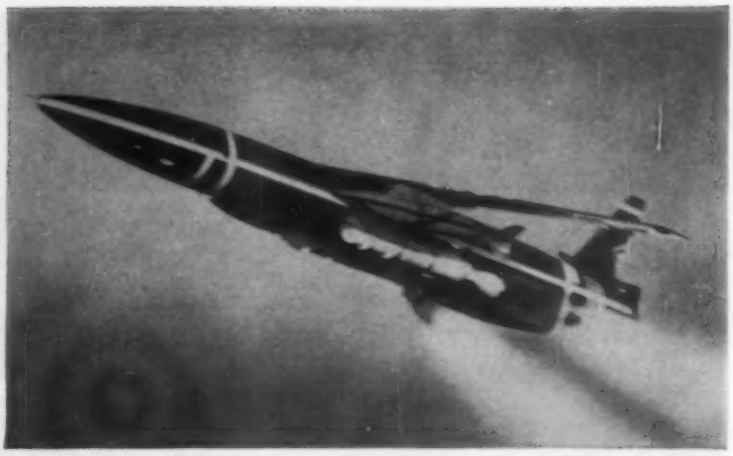
The MISSILE:

U. S. A. F. Northrop's SM-62 Snark, with a range of more than 6000 miles. Now operational, the Snark is America's first intercontinental guided missile. Powerplant is a Pratt & Whitney J-57 turbojet. Guidance is by a stellar-monitored inertial system.



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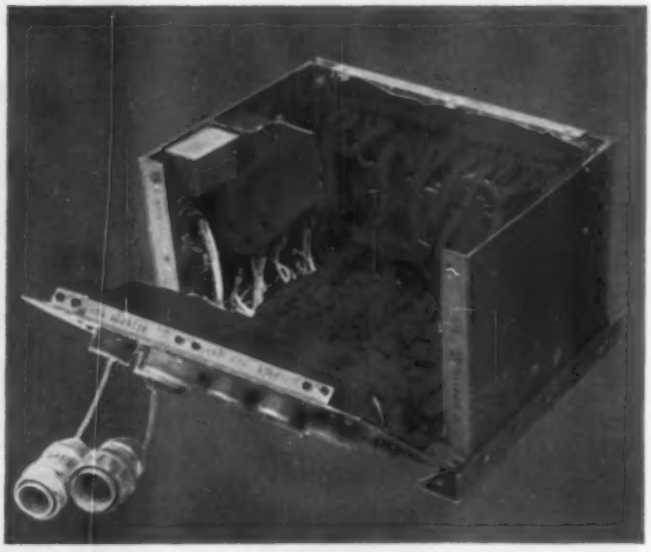

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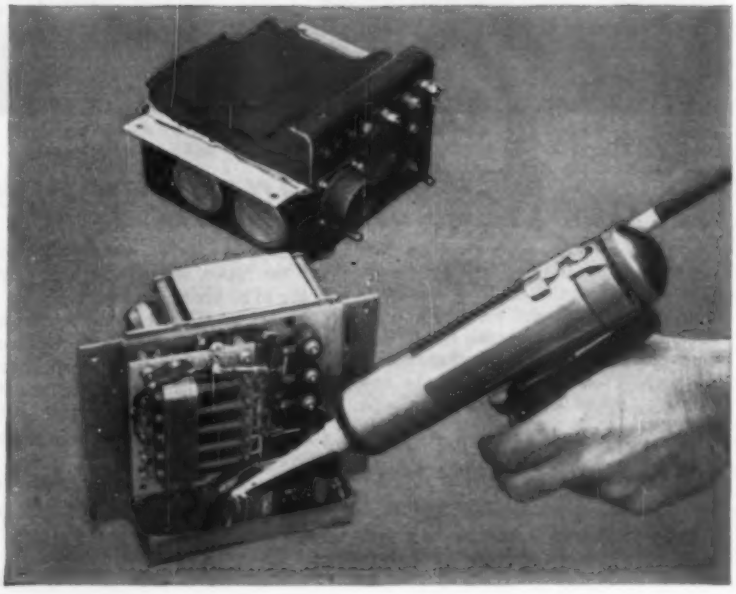

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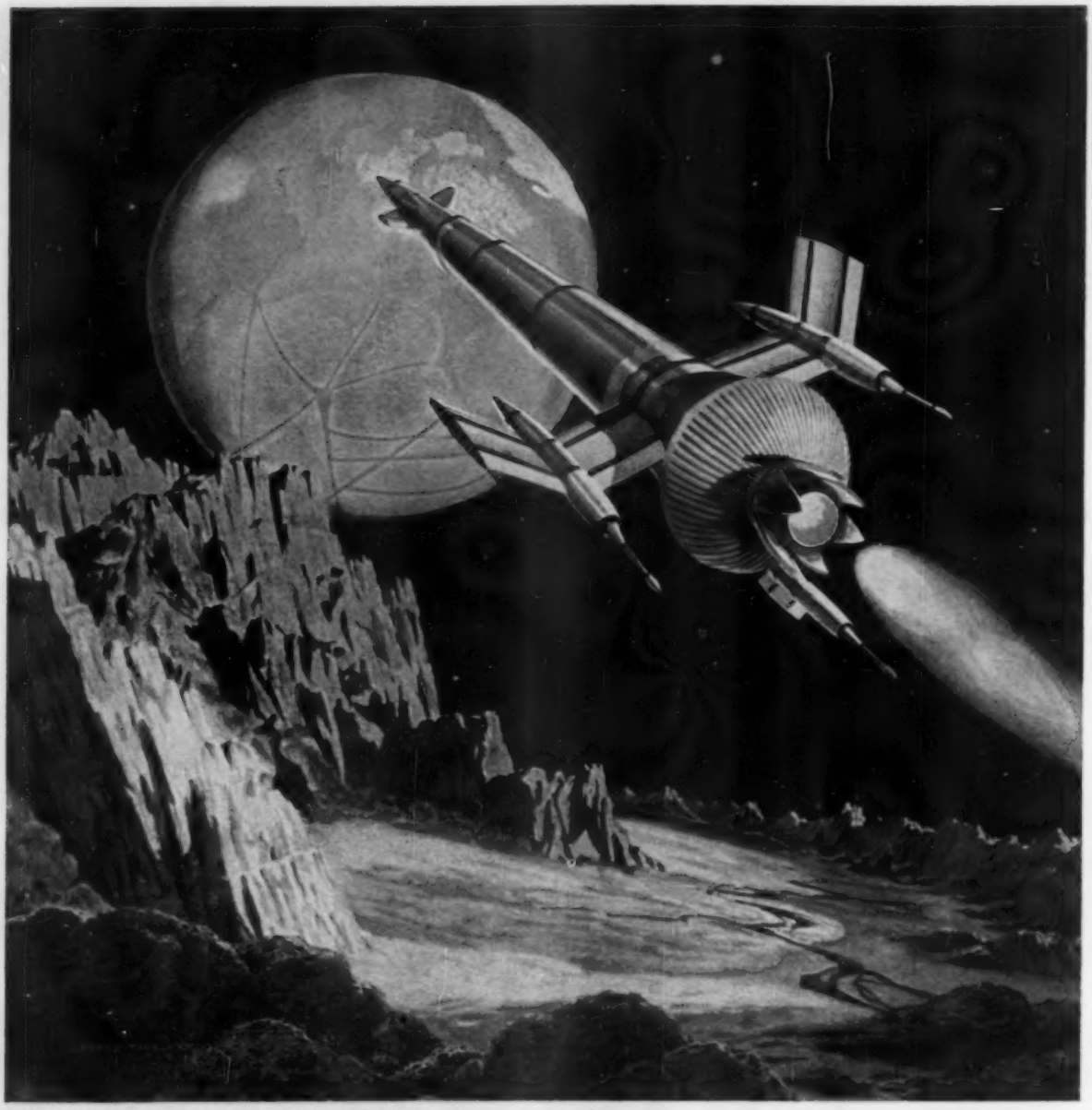

STEPS IN THE RACE TO OUTER SPACE

Mars Snooper

This nuclear-fueled reconnaissance craft is preparing to land on Mars' outermost satellite, Deimos—12,500 miles away from the "red planet" (center) and 35 million miles away from the Earth. Deimos' gravitational pull is so slight that a featherlight landing could be made, and a take-off could be accomplished with little more than a shove of the pilot's foot! (At Deimos' orbital speed, such a push would start the ship back to Earth at 3000 miles per hour.)

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December 8, 1958

Aviation Week
Including Space Technology

Vol. 69, No. 23
Member ABP and ABC

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COVER: USAF GAM-72 Quail decoy missile, developed and manufactured by McDonnell Aircraft Corp., is dropped from the bomb bay of a Strategic Air Command Boeing B-52. The missile previously underwent captive and glide flight tests at Holloman AFB, N. M. (AW Dec. 1, p. 31). Quail is powered by a General Electric J85 turbojet. The missile is parachute recoverable.

PICTURE CREDITS

27—Hiller; 29 (left)—Wide World (right)—United Press; 31—Bethlehem Pacific Coast Steel; 34—North American Aviation; 49 (top)—Douglas (bottom)—Boeing; 55—Erwin J. Bulban; 57—Lockheed; 61—Universal-Cyclops Steel Corp.; 67, 69—Chicago Aerial Industries Inc.; 76, 77, 79, 81, 84—Bell Helicopter Corp.; 92, 93, 95, 103—Armstrong Whitworth; 107—Russell Melcher; 108—Pioneer Parachute Co.; 112 (top)—Turbomeca (bottom)—Eastfoto.

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HOW MAGNESIUM ALLOY SAND CASTINGS IMPROVE AIRCRAFT DESIGN

New thin-wall castings replace complex, costly fabrications

THE number of magnesium alloy sand castings used in aircraft and missile assemblies is growing by leaps and bounds. One reason is the general recognition among designers that magnesium saves precious weight without sacrificing strength and rigidity. Two other reasons are also responsible for the rapid increase in the use of magnesium castings in aircraft design:

1. New elevated-temperature alloys.
2. Simplified design, construction characteristics of magnesium sand castings.

THREE ALLOY SYSTEMS are now commonly used for magnesium sand castings — magnesium-aluminum-zinc, magnesium-rare earth and magnesium-thorium.

Mg-Al-Zn alloys have high strength and very good casting characteristics. They provide stability of properties up to 200°F. and often are satisfactory as high as 350°F. A number of different alloys in this system are available, each having a characteristic combination of properties — yield strength, pressure tightness, ductility, weldability, etc. In addition, these alloys are heat-treatable to obtain a range of strengths.

For the 350°F.-500°F. range, the magnesium-rare earth alloys can be used. These alloys have excellent pressure tightness as well as good creep strength at temperature and can also be heat-treated.

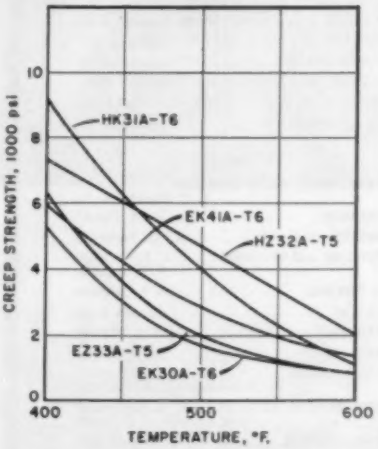
FOR TEMPERATURES UP TO 700°F., the magnesium-thorium alloys are used. HK31A is particularly good for short time elevated-temperature uses where high stresses are encountered. HZ32A is excellent for low stress performance over a long period of time. Both have creep characteristics superior to the Mg-Al-Zn and Mg-rare earth alloys, and both are available in the heat-treated condition.

Magnesium alloy sand castings are being made in a large variety of shapes and sizes, ranging from a few ounces to over 1600 lbs. The favorable casting characteristics of magnesium in general permit unusual flexibility in design.

THIN-WALLED SECTIONS, for example, can be produced to replace intricate fabrications involving several operations. Although thin walls are normally kept small in area, new techniques have been developed to obtain large thin-walled sections with better than average surface uniformity.

For more information about magnesium sand castings and their use in aircraft design, contact your nearest magnesium foundry or Dow sales office.

TYPICAL THIN-WALL magnesium casting used in a missile control surface.



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Today and Tomorrow

There are three basic fallacies underlying the process by which the annual budget for the defense of these United States is now formulated.

First, there is no real over-all strategic policy and definite tactical requirements developed for the defense problem as a whole. Whatever policy has prevailed during the past decade has been primary reliance on the Air Force as a "dynamic deterrent" to scare any potential enemy from major aggression by the threat of its delivery capability of megaton-yield bombs with B-47s and B-52s.

In this atmosphere, the Navy and Army had a fuzzy strategic role. Consequently, they devoted a major portion of their efforts to impinge on the primary USAF mission of long-range megaton bomb delivery. Although this policy may have served its purpose in the decade now ending, it is obvious that something more varied and flexible than this "one-punch" strategy is required for the immediate future.

Second, the trend of allowing comptrollers to make operational military decisions, both on new weapons and on the scope of operations contemplated, has reached the point where the budgeteer is making fundamental military policy decisions by his manipulation of funds. The role of the comptroller as the key decision man in formulating Pentagon policy began with the Unification Act of 1947 and the coalition of the Army, Navy and Air Force in the Defense Department. The steady rise of the comptroller as the decisive force in making fundamental military decisions stems from the inability of the services to make any decisions on inter-service matters.

We have little sympathy with some of the service leaders who organized and led inter-service attacks with all the zest of action against a foreign foe and with little regard for the fiscal resources of this nation. These are the men who, by their bitter, insoluble bickering, really created the current dominant role of the comptroller in forging military policy. However, dominance of the comptroller is really not the way to come up with sound military policy, even though it may produce a more balanced budget.

Third, there is an increasing tendency on the part of newcomers in the Defense Department and its related technical development to become increasingly enamored by the glitter of radically new weapons that are little more than a gleam in the engineer's eye at the sacrifice of the more mundane weapons now in service with proven reliability. This is a pitfall into which the budgeteers fall most often and where they can most easily be impaled on the tops of their sharp pencils.

We can see this tendency developing strongly in the Fiscal 1960 defense budget where major cuts in production programs of weapons just now reaching, or on the verge of reaching, operational capability are being carved completely from the future budget. From a budgetary view, this is attractive because it is weapon production programs that require the largest lumps of funds.

The justification for eliminating the next generation of modernization for the armed forces in being is simply that so much more powerful and technically sophisticated weapons are looming on the distant development horizon. Development programs are relatively small financial potatoes measured in millions compared to the multibillion-dollar production programs. So, says the budgeteer, why spend all this money on production of a new, improved military weapon when we can already see a much better one just around the technological corner, and we can get my budget to fit much better this year?

This is perhaps the most dangerous of the trio of trends discussed on this page today. For, if followed to the extent it is planned for Fiscal 1960, it will strip the element of modernization from our armed forces in being that should keep them competitive with their potential opposition. It could easily open a dangerous technical differential between friend and foe. For these shining new weapons that are always gleaming on the technical horizon have a habit of taking much longer to develop into operational reliability than the budgeteers calculate. By the time this is apparent, political shifts usually have wafted the budgeteers into other areas of endeavor, leaving a new crop to face the consequences of these somewhat naive policies.

It is a sad fact of life in our world today that maintaining adequate defense is a tremendously expensive and technically demanding operation, but the consequences of failing to maintain the technical pace and develop the military ingenuity to fit new weapons into an effective strategic pattern would be far more disastrous than some budgetary misalignment. For it is in this critical area of technical development pace and modernization of military forces in being that a battle as decisive as any pitched battle in history is being fought today.

The military and technical chess game being played between the U. S. and Soviet Union is a key to the future of this globe we inhabit and, as in any chess game when both strategy and timing are faulty, one contestant may eventually find himself in an indefensible position with the only alternatives open to either resign the game or enter a futile end game that slowly strips him of his resources and power.

Lets look at some of the key areas in which the glitter of future weapons is blinding the budgeteers to the reality of today and tomorrow. In air defense, they hope to eliminate manned interceptors and substitute an all-missile defense system. With the performance capability, range and reliability of the current and next generation of air defense missiles this is the sheerest folly. A combination of long-range interceptors and medium-range missiles could provide an air defense system of unusual flexibility and efficiency. But either alone cannot do the job singlehandedly for the foreseeable future.

In the long-range megaton delivery system business, it is again foolish to search for an "ultimate weapon" and rely on a single delivery method. Flexibility and variety are still the keys to this problem. All of the possibilities of water, air and land-based delivery systems for missiles of varying ranges should be combined into a single operational capability that provides sufficient scope and mobility to ensure effective functioning in the moment of crisis.

Nor can we neglect the fundamental need for the swiftest possible logistics system to support combat operations of all kinds at the pace to which future conflicts are already geared.

We badly need a thorough overhaul of our military strategy and the programs required to support it to meet the new political and technological problems we face in the next decade.

—Robert Hotz

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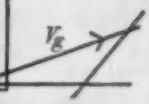

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WHO'S WHERE

In the Front Office

Charles J. Gallant, formerly vice president and general manager of the Columbus, Ohio, division, elected executive vice president, North American Aviation, Inc., Los Angeles, Calif. **W. H. Yahn** now is acting general manager of the Columbus division. North American also elected the following senior vice presidents: **Gerald B. Brophy**, general counsel; **R. A. Lambeth**, finance and treasurer; **J. S. Smithson**, administration; **Laurence L. Waite**, engineering and planning.

Brig. Gen Don Flickinger, assistant to the deputy commander for research, Air Research and Development Command; **Col. Jack Bollerud** succeeds Gen. Flickinger as Director of Life Sciences.

Francis H. Burr, Boston attorney, a director of American Airlines, Inc.

C. T. Wilkins, chief designer, and **John Cunningham**, chief test pilot, elected directors of The de Havilland Aircraft Co., Ltd., Hatfield, England. Also: **R. E. Bishop**, deputy managing director, and **R. M. Clarkson**, research director; Messrs. Bishop and Clarkson continue as directors.

Enrique Chavez, first vice president, LAV, the Venezuelan Airline.

Irving Roth, vice president-finance, and **Charles C. Cilley**, corporate treasurer and comptroller, Northrop Aircraft, Inc., Beverly Hills, Calif.

Richard C. Wynne, vice president-marketing, Non-Linear Systems, Inc., Del Mar, Calif.

Robert G. Belote, vice president-industrial relations, and **George J. Papas**, vice president-purchasing, Rheem Manufacturing Co., New York, N. Y.

George S. Oberdorf, a vice president, The Flying Tiger Line, Inc.

Group Capt. Arnold H. Mielke, vice president-Western Division, Winnipeg, of Canadian Aviation Electronics, Ltd., Montreal, Canada.

Honors and Elections

Promoted to temporary grade of brigadier general are **Col. Ben E. Lebailly**, deputy director of USAF's Office of Information Services, and **Col. Benjamin G. Holzman**, commander of USAF's Office of Scientific Research.

Dr. John Francis Victory, assistant to the administrator of the National Aeronautics and Space Administration, will receive the Wright Brothers Memorial Trophy at the Wright Day Dinner of the Aero Club of Washington, Dec. 17, Sheraton Park Hotel, Washington, D. C. The trophy is awarded annually "for significant public service of enduring value to aviation in the United States."

Changes

William M. Duke, director-System Engineering Division, Space Technology Laboratories, Inc., Los Angeles, Calif.

C. T. Ray, head of the newly established Commercial Products Department, The Martin Co., Baltimore, Md.

(*Continued on page 114*)

INDUSTRY OBSERVER

► Theoretical study of non-nuclear explosion effects on the moon is nearing completion at Aerojet-General Corp. Aim of the company-sponsored project is to determine the feasibility of blasting lunar surface particles into space for pickup and analysis by an orbiting or passing lunar probe, which would telemeter information back to earth.

► Powerplant used on General Electric Heat Test Reactor Experiment No. 3 (HTRE-3) burned and apparently was destroyed during recent ground tests of the turbojet engine running on nuclear power at Atomic Energy Commission facilities in Arco, Idaho. Tests are being made in conjunction with the U. S. program to develop an atomic-powered aircraft (AW Dec. 1, p. 29).

► Industry presentations in Air Force's early warning and control system competition are scheduled to be made this month. Competition between major bidders—Lockheed, Convair, Douglas and Boeing—is intense since a substantial number of aircraft are scheduled to be involved.

► Watch for Navy to let a contract within the next two weeks for development of its Eagle long-range air-to-air missile project. After several months of uncertainty, Navy has won its battle with Defense Department fiscal planners who had wanted the service to adopt the Air Force-Hughes GAR-9 already under development for use on North American Aviation's F-108 Mach 3 interceptor. Likely contractor: A Bendix-Grumman team.

► Raytheon Manufacturing Co. is pushing development of the Super Hawk, advanced version of Army's Hawk low-level surface-to-air missile.

► Schedule for the Titan intercontinental ballistic missile has slipped slightly, while the Atlas schedule has been accelerated, spreading the operational readiness dates between the two missiles to approximately 18 months.

► Army's Redstone Arsenal is taking bids on low-cost drones for three regimes of service. Versions include one subsonic and two supersonic (up to Mach 3) configurations. Bidders will include Cessna, Martin, Beech, Lockheed Missile Systems Division, Ryan and Radioplane.

► Contracts are being awarded by Navy's Special Projects Office for Polaris fleet ballistic missile training gear to ensure that the crews will be indoctrinated and ready for service well in advance of the delivery of the actual missile-submarine weapon system.

► Second stage of a meteorological rocket built by the Krakow Division of the Polish Society of Astronauts and the Rocket Section of Krakow's Metallurgical Academy is now undergoing tests. Second stage, which provides approximately 220 lb. thrust, is 820 mm. long, 63 mm. in diameter. It weighs 4.35 kg. and carries one kilogram of solid fuel. Working pressure is 40 kg. per square centimeter. Preparations are now under way to build and test the first stage of the rocket.

► Air Materiel Command has requested that the Cessna L-27A be given the Air Force designation of U-3A, giving the plane a utility aircraft code designation.

► Navy and Air Force Air Research and Development Command have joined forces in efforts to draft specifications for a supersonic target drone with a speed capability of Mach 3. Aim is to blend operational requirements in order to determine a standard configuration that will meet the demands of both services.

► Relative position of Midway Island and Navy's missile test center at Point Mugu, Calif., has been determined to an accuracy of within 300 yards by comparative observations of the Vanguard satellite in its precisely-known high altitude orbit. Previous calculations were off by about four miles. Midway station probably will be used in connection with long-range missile and satellite firings from the Pacific Missile Test Range, of which Mugu is a part.

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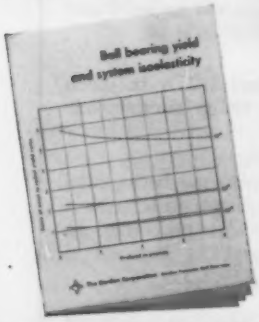

Write for the Barden booklet, "Ball Bearing Yield and System Isoelasticity." An aid to application of precision instrument bearings, it offers background data on axial and radial play, axial take-up, preloading, isoelastic bearings and achievement of system isoelasticity.

To achieve system isoelasticity and minimize moment errors, gyro rotors need bearings that provide rotational accuracy, exact positioning and controlled axial and radial yield rates.

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Inner ring raceways ground in shaft—to simplify rotor design . . . reduce mating part errors . . . improve bearing alignment

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Washington Roundup

Dollars vs. Security

Seemingly implacable Administration orders to hold the line on defense spending are forcing across-the-board slashes on almost every facet of the military services' Fiscal 1960 budgets. With the dollar taking precedence over actual defense needs, Air Force has been told it will be allowed only approximately 600 new aircraft during the fiscal year, of which about 200 will be combat planes. Navy, under Administration plans, will receive authority for approximately 400 aircraft and has decided to sink all available funds into combat types.

In another area, Defense Department has cut all Fiscal 1960 funds for air-breathing missiles, knocking out Navy's Chance Vought Regulus II submarine weapon system and Air Force's procurement program for the Martin Mace. Other cuts include Convair's F-106 interceptor. The company's B-58 Mach 2 bomber probably will suffer a similar fate (AW Dec. 1, p. 25).

Thor, Jupiter Cut

In still another economy move, Defense Department has tentatively decided to halt production of both the Douglas Thor and the Chrysler Jupiter intermediate range ballistic missiles after current production contracts are completed. Contracts will deliver approximately 60 Thors to Great Britain, 45 Jupiters to Italy. Another factor in the decision to cut production of the two missiles is the fact that England and Italy are the only two NATO countries who have agreed thus far to accept the weapons (AW Nov. 24, p. 32).

Missile Management

General Accounting Office hopes to submit a complete report on Air Force management of the ballistic missile program to Congress by June. It will include a comparison and evaluation of the USAF program with the Navy and Army program. A GAO spokesman said the ramifications of the recent merger of Ramo-Wooldridge Corp., which participated in the management of the USAF ballistic program, with Thompson Products Inc. (into Thompson Ramo Wooldridge, Inc.) also will be weighed by GAO. For seven months, GAO has tried to obtain a report on the Air Force missile program made by the USAF Inspector General (AW Nov. 24, p. 34).

Contract Defended

Meanwhile, Air Force last week defended an 11.9% fee paid to Ramo-Wooldridge Corp. for a cost-plus missile managing contract against charges that the payments were excessive. Max Golden, USAF general counsel, told the House Subcommittee on Manpower Utilization that an extraordinary effort was asked of the firm in managing the ballistic missile program and that Ramo-Wooldridge was excluded from production and development contracts in which additional fees would be involved.

Golden added that average cost-plus-fixed-fee contract ranged from 6 to 7%. The subcommittee has criticized the action and said 60 top executives of the firm received an average salary of $30,000 a year as compared with $15,000 average salaries for smaller concerns.

The subcommittee also is charging that the high salaries paid by private industry make it difficult to keep key personnel in government, adding that it is a "tragic thing" when the salaries are made possible through government contracts. Rep. H. R. Gross (R.-Iowa) has suggested that the government should impose a ceiling on top salaries paid to cost-plus contractors.

Plant Sales

Air Force is considering proposing to Department of Defense that contractors be permitted to purchase plants when military business starts tapering off. This, USAF believes, would enable them to gradually develop new production in the facilities. At present, plants cannot be sold until they have become idle and are declared surplus for disposal by the General Services Administration.

Railroad Campaign

Accelerated campaign by railroads to eliminate airline subsidies and impose user charges for airline operations is ricocheting in some areas. Campaign is drawing public attention to responsibilities of transportation systems to communities and is raising some questions as to whether railroads are fulfilling obligations to maintain proper railroad crossings and station facilities.

In at least two state legislatures during the past six months, safety factors of railroad grade crossings have been brought onto the floor for discussion. Although no direct action has been taken by the states concerned on the issue, the subject is not likely to be allowed to rest, particularly if local communities continue to protest against unimproved safety measures at railroad crossings and outdated station facilities.

Bid by Delta

Delta Air Lines is making a bid to capture the lucrative Miami-Havana route now operated by National. Basing its arguments on the Pan American-National lease-stock transfer agreement now before the Civil Aeronautics Board (see page 43), Delta told CAB that approval of the joint proposal would place Pan American in control of National, thereby eliminating competition between U. S. flag carriers on the route. Contending that the Board has the power to compel such a transfer of operating authority, Delta asked that it be considered for the route if CAB approves the Pan American-National agreement.

Difficult Capture

Supplemental air carriers are finding it difficult to tap any of the scheduled airlines' traffic. Hoping to capture the excess of passengers available because of strikes among major carriers, the Independent Airlines Assn. asked the Civil Aeronautics Board to lift the 10-trip per month restriction under which supplementals operate and to allow the organization to coordinate the efforts of its members in handling the extra traffic. The Supplemental Air Carriers Conference termed the IAA petition a "publicity stunt" but nonetheless filed in behalf of two SACC members for a lifting of the 10-trip authority during the strike period. Since these petitions were filed three weeks ago, Trans World Airlines, one of the two major carriers on strike, has resumed operations. Neither IAA nor its competing organization, SACC, has received any reply from the CAB.

—Washington staff

Airline Growth Pattern May Be Broken

Aviation Week survey indicates strikes, passenger decline will hold 1958 profits to 1957 levels.

Washington—A critical decline in passenger traffic development coupled with the grounding of four airlines by labor strikes during 1958 threatens at least a temporary halt to the industry's historic growth pattern for the first time.

Although it is still too early to evaluate the full effect labor strikes will have on the operating incomes of the domestic trunkline carriers for the year, an AVIATION WEEK survey indicates that chances are slim for any gains in revenue passenger miles for 1958 over the previous year. Even without taking the strike factor into account (see p. 41), increases in this category will amount to less than 1%.

The trunkline industry probably will report a net profit of $30 million for the year as compared with a $27 million net in 1957. However, the 1958 earnings reflect a Civil Aeronautics Board depreciation policy which, financial analysts say, will have the effect of inflating the year's net profits. Best estimates place this inflated, or "paper" profit, at $14 million so that actual earnings can be put at about $16 million (see p. 42).

The Board required the airlines to adopt an across-the-board seven years depreciation with a 15% residual value for aircraft and spares effective Jan. 1, 1957. Refusal of the Supreme Court to back a Board rule regulating airline depreciation accounting practices last month (AW Nov. 17, p. 41) now permits the carriers to return to original depreciation procedures that range from between four and seven years depreciation and 5 to 10% residual value.

Domestic revenue passenger miles for the year is now estimated at 24.7 billion for the year compared to 24.5 billion in 1957, an insignificant 6/10ths of 1% increase. Domestic revenue ton miles will show a gain of about 1.5%, from 2.72 billion to 2.76 billion.

Revenue Passenger Miles

Revenue passenger miles and revenue ton miles operated by local service carriers will show an approximate 7% increase this year over 1957. A 5% gain can be expected in the number of revenue passenger miles operated by U.S. international carriers.

The leveling-off of revenue passenger miles, predicted last year by AVIATION WEEK (Dec. 30, p. 39), reflects the economic depression during the first half of 1958. An abrupt recovery in traffic volume during October and November has prevented the traffic picture from being as grim as it might have been had the recession continued into Fall.

Load factors during the year dropped consistently each month until October when the first increase since July, 1957, was recorded. Since June of this year, load factors have remained below the 60% mark, a decided contrast to the average 64.5% monthly load factor recorded during the record post-war year of 1956.

Revenue passenger miles dropped each month from May through July, a normally healthy traffic period, but rose again in October to reach the second highest monthly figure for the year. Early reports indicate that a continued rise will be reported for November despite the strikes against Capital, Eastern and Trans World airlines.

Operating revenues will show an increase of about 14% for the year, due primarily to the 6.6% fare increase granted last February and the elimination of the round trip discount and adjustment of the family fare plan in October. Expenses will continue to show sharp increases and may show as much as a 20% rise this year over 1957.

Profits will be bolstered to some degree by the sale of equipment. However, the profit squeeze, which first became evident in 1956, can be expected to continue into 1959 since there seems to be little hope that increases in labor and fuel costs can be curtailed. Next year, additional transitional costs resulting from the conversion to turbine equipment will intensify the expense problem.

In addition, airlines which introduce jet equipment this year will be forced to accept the added burden of interest payments on loans covering the purchase of the jet equipment. Loan costs can make the difference between a profit and loss. For example, Capital Airlines reported a net profit of $564,874 for the third quarter of 1958 but told the Civil Aeronautics Board that it had obtained a moratorium on payments for its Vickers Viscount turboprop transports in July, August and September totaling $2.4 million. Depreciation of $2.5 million for the three-month period was taken on the equipment.

Whether the third quarter strength shown in October and November will carry through December depends to a large extent upon weather conditions in heavy traffic areas during the month. Poor traffic showing during the first quarter of 1958 was attributed by five airlines to unfavorable weather conditions throughout the eastern sector of the U. S. during the latter part of the initial reporting period.

Available seat miles probably will return to a marked growth pattern in 1958 as a direct result of the introduction of turbine-powered aircraft during the year. Available seat miles, however, leveled-off sharply during the latter part of 1958. This condition, which has been abetted by the withdrawal of seat-miles as the result of strikes in November, will help strengthen the load factors of individual carriers continuing their operations.

Available Seat Miles

Available seat miles in January reached 40.2 billion, a 12% increase over the previous year. This rate of increase subsided rapidly throughout the year until October when a monthly rise of only 1.2% was reported. Nevertheless, the 41.9 billion seat miles operated in October was an all-time high for the domestic trunkline industry. It is highly possible that this monthly picture may reach the 50 billion mark by December, 1959.

Most carriers attribute the slow climb in available seat miles to a tightening of scheduled operations due to increased competition on major routes and the general drop in traffic growth.

Revenue passenger miles reached their highest mark in domestic airline history in April when 24.71 billion revenue passenger miles were recorded. This, however, represented only a 1% increase over the previous March when a 12.4% increase was registered. In May, June and July, the volume of revenue passenger miles fell off steadily. A 1% monthly increase was reported in August, but the total remained virtually the same in September. In October, monthly revenue passenger miles climbed 4.3% over the previous October.

Load factors for the domestic trunkline industry similarly rose in October to show a 1.78% increase over the same month of 1957. It was the fourth monthly increase that has taken place since March, 1956, when the steady rate of decline first began.

Rascal Terminated

Washington—Air Force has ordered termination of the Bell Rascal air-to-ground missile for the Boeing B-47 bomber. Existing production contracts for a limited number of Rascal missiles and spare parts are practically completed, and the Air Force said there will be no further orders.

Hiller X-18 VTOL Readied for Rollout

Hiller X-18 tilt wing transport, developed for U. S. Air Force, is scheduled to roll out today at Hiller Aircraft Corp.'s Palo Alto, Calif., plant. The aircraft, which has vertical and short takeoff and landing capabilities (AW June 9, p. 45), is shown with wings in conventional forward flight position. Aircraft is powered by two Allison T40 turboprop engines coupled with Curtiss-Wright six-bladed turboelectric propellers; each T40 consists of two power sections coupled to a common reduction gearbox. In addition, Hiller X-18 has a Westinghouse J34 turbojet engine on aft section of the fuselage, used for control of the aircraft's pitch in hover or transitional flight.

Fuel System Icing Described As Major Hazard to Jet Planes

Washington—Serious fuel system icing has contributed to approximately 11% of all Air Force accidents during the past 30 months, according to the USAF Directorate of Flight Safety Research.

Problem, a contributing factor in 37 of the 352 accidents during the period, apparently is greatest in large jet aircraft and may soon confront the airline industry.

Three Steps Taken

Three major steps already have been taken by the Directorate of Flight Safety Research to stop icing in fuel systems:

- **Improved quality control** of fuel as it is received from commercial firms.
- **Development of a hydrant system** for dispensing jet fuel that will strip it of all water that it contains in solution as well as suspended in globules.
- **Modification of fuel systems** in various aircraft such as removing filtering screens and installing fuel heat exchangers.

These three objectives have been pushed by the Directorate, headed by Maj. Gen. Joseph Caldara, since early this year after a Boeing B-52 crash directly attributable to fuel icing. Following this accident, fuel system icing was made the subject of a conference held every two months by the Directorate in order to get Air Force operational and maintenance personnel together with industry for an exhaustive discussion of one particular safety hazard.

While fuel icing has always been an operational problem in aviation, jet fuels have complicated the situation because they have a much greater tendency to absorb water into solution than does gasoline.

Another complication has been identified since large jets became operational. These aircraft have shown a greater tendency toward fuel icing than smaller aircraft such as fighters, even though there is no basic difference in the mechanical functioning of their fuel systems.

The increased icing tendency is attributed to the large amounts of fuel that must be pumped through large lines at a comparatively rapid rate.

As a result of the safety conference concerned with fuel icing, two companies developed mobile ground systems with their own funds which could be used to filter water in solution as well as suspended moisture and debris as the aircraft were refueled. The Air Force subsequently purchased a number of these units for qualification testing and, at the same time, covered the complete development costs of the equipment.

Modifications have included putting bypass valves around fuel strainers so that flow will not be stopped in the event they ice up, and the complete removal of the strainers. Fuel heat exchangers also have been designed for use in flight.

Some of these are now in developmental test but they have a number of serious limitations such as high weight and, in some cases, present a fire hazard and disrupt the weight and balance of existing aircraft.

Far From Solved

The problem is far from being completely solved, and the Directorate of Flight Safety Research is pressing industry and Air Force commands for immediate and long-range fixes.

Full-blown research and development projects, while necessary for a final and efficient solution, do not meet the Directorate's requirements for an immediate fix that will reduce accidents and keep operational capability high in all weather.

Nuclear Plane Details Spur Wide Reaction

Washington – Widespread reaction, including congressional demands for an acceleration of the U. S. nuclear plane program, was touched off last week by AVIATION WEEK's exclusive story of Dec. 1 (p. 26) detailing initial Soviet test flights of a nuclear-powered bomber.

Queries to the Defense Department by newsmen reporting on the AVIATION WEEK story, which was widely circulated by U. S. and foreign newspapers, received veiled confirmation. The Wall Street Journal reported, for example, that the existence of a Soviet nuclear bomber was "acknowledged by military men close to the U. S. nuclear plane program."

The Washington bureau of the New York Times reported, "Pentagon sources said today that they had no doubts that the Russians had flown or soon would fly an atomic-powered airplane."

Other newspapers and wire services querying the Pentagon received similar replies or, in some cases, a "no comment."

The office of one Defense Department official spokesman told a newsman, "We have been told not to deny any confirmations of the story."

Later, Defense Secretary Neil H. McElroy said in reply to a query that he did not know whether the Soviets had flown an atomic aircraft but that he was "highly skeptical" of the report. McElroy acknowledged, however, that the USSR may have a "slight lead" over the U. S. He added that there are no plans at present to change the pace of the U. S. program.

In reporting on McElroy's statement, Jerry Greene, Washington military correspondent for the New York Daily News, said that there "are within this country actual photographs of the Russian atomic aircraft."

On Capitol Hill, Rep. Melvin Price (D.-Ill.), chairman of the Research and Development Subcommittee of the Joint Committee on Atomic Energy, called for the acceleration of the U. S. nuclear-aircraft program and said:

Critical Stage

"We have reached a critical stage in our nuclear aircraft program (ANP). Either we push forward vigorously to a successful conclusion of our efforts or we forfeit, once again, our technological leadership.

"The history of the ANP program is replete with examples of indecision, indifference and ineffectiveness which have plagued the program from the start.

"It is indeed ironic that, while the scientists and engineers actually working on the project in the field have consistently moved forward toward achievements of their technical objectives, they have just as consistently had the rug pulled out from under them by bureaucratic snafus in Washington.

"There is a limit beyond which even the most dedicated people in the field cannot be expected to go in their efforts to maintain America's scientific leadership. We have reached that limit."

Price said he also had been informed that a "policy-level meeting is to take place in the near future within the Administration to discuss acceleration of the ANP program." He also added:

"It is essential, not only to the national interest but to the morale of our working scientists and engineers in the field, that a clear cut decision be made at this time as to the objectives of the program. This decision should include target dates for a ground test of the prototype and for the first flight."

Price said that the Joint Committee on Atomic Energy "as yet has received no new information on the extent of the Soviet success in their nuclear aircraft program" but added that "their objective of nuclear-powered flight has been known for some time.

"More than a year ago, my own discussions with Soviet officials during a trip to Russia confirmed their great interest in powering an airplane with nuclear energy."

Sen. Dennis Chavez (D.-N. M.), chairman of the Senate Aviation Subcommittee, blamed the Administration for failing to push the nuclear plane program, adding that Congress would provide "all the money they want" to get an atomic aircraft flying.

Sen. J. William Fulbright, (D.-Ark.), a member of the Senate Foreign Relations Committee, also criticized this country's "weak, apathetic leadership" in failing to push the atomic plane program.

Hosmer Wary

Rep. Craig Hosmer (R.-Calif.), however, issued what he termed a "stern warning against misinterpreting the danger if unsubstantiated reports Russians are flying a nuclear engine prove true."

Hosmer, a former Atomic Energy Commission attorney, said the Soviets probably have "a flying test bed for nuclear aircraft engine experiments, not a nuclear-powered aircraft." Lifting the nuclear aircraft engines to high altitudes for test purposes, Hosmer said, "is a cheap and dirty way to test that only the Soviet butchers of Hungary, with their contempt for human life and safety, would adopt. . . . Almost any malfunctioning of the experiment would most certainly produce dangerous radiation." Hosmer also warned:

"Extreme caution should be exercised regarding the citing of the rumors of Soviet nuclear aircraft power, either as an 'accomplishment' in criticism of U. S. programs, or as an argument for a 'crash' U. S. program. Information is expected to be confirmed shortly by means which cannot be disclosed as to a motive of the Kremlin to throw the U. S. weapons program off balance. This office will issue a release when and if the confirmation occurs."

Germans Act on F-104 Funds

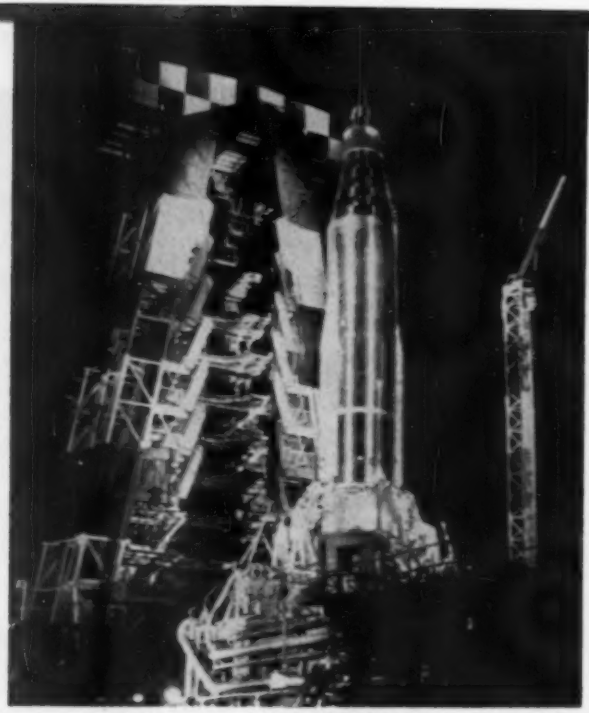
Geneva—West German government's budget commission has approved in principle the funding for purchase or license production of Lockheed F-104 Starfighters, Fiat G.91s and Sud Aviation Alouette helicopters.

Total money approved is $512.5 million. Major share of the budget—an estimated $312.5 million—goes for off-the-shelf purchase of a few Starfighters and license production of the greater portion of the order. Budget figure for 200 G.91s is $187.5 million. Sud's helicopters, which will all be purchased from the French manufacturer, account for $12.5 million.

Powerplant costs are included in these estimates. Details of license production of the Starfighter's General Electric J79 and Fiat's Bristol Orpheus turbojets have yet to be worked out.

Manufacturers expect that all licenses will be negotiated with and held by the West German government rather than with individual members of German industry, despite many existing agreements in principle between companies. This way the government will control work load distribution through industry. Most sources expect that Starfighter production will be apportioned between member companies of Flugzeug-Union Sud, which includes Bolkow, Heinkel, Messerschmitt and Siebelwerke. Dornier, lined to the southern group only by geography, will probably get Fiat G.91 production.

Both Fiat and Lockheed sources confirm that although they have been aware of German intentions for a while, neither company has any official "paper with signatures" as yet, and no contracts have been signed.



Atlas Completes First Full-Range Firing

First full-range firing of Air Force-Convair Atlas intercontinental ballistic missile from Cape Canaveral, Fla., traveled 6,355 statute miles, landing 30 mi. beyond its impact point in the Ascension Island area. Conical, lightweight honeycomb nose cone was used in the test rather than the heavy copper heat sink cone scheduled for operational models to compensate for weight of test instrumentation carried.

The AVIATION WEEK report on the Soviets' nuclear-plane progress also was commented upon on a number of newspaper editorial pages, including those of the Washington Post and the New York Daily News. The Post editorial said, in part:

". . . If the tests are successful, Soviet nuclear-powered bombers, equipped with short-range atomic missiles of high accuracy, would prove to be a graver, more immediate threat than the ICBM. Cruising the globe for long periods on normal patrols and beyond U.S. surveillance, these swift giants could suddenly and secretly be diverted from unexpected quarters toward strategic targets like our own bomber and ICBM bases. They might get in crippling blows before our retaliatory forces were airborne.

". . . If the formidable technical problems can be solved—and we cannot be certain that the Russians have yet solved all of them—the nuclear bomber deserves the most energetic attention. Unfortunately, as in the satellite and ICBM programs, pre-eminence in this field has been allowed the Soviet Union by the foolhardy niggardliness of an Administration that thinks America cannot afford the defense that it needs."

The New York Daily News, after complimenting the Air Force and Convair Division of General Dynamics Corp. for the successfully 6,000-mi. range test firing of the Atlas intercontinental ballistic missile, warned on its editorial page:

"But let's not get over-confident or complacent. The respected trade journal AVIATION WEEK reports that the Russians about six months ago completed an atom-powered bomber which can cruise at nearly 1,400 mph. and might be able to remain aloft indefinitely.

"Such a machine could be used for continuous reconnaissance around the world or as a missile-launching platform —provided, of course, nobody shot it down.

"This seemingly reliable news had better be taken as a challenge by our aviation and atomic scientists to speed up development of the U.S. atomic plane so long discussed and so often reported well on its way to being unveiled. Let's have some results—at least as fast as the results delivered by the Atlas designers."

Capital Joins New Aircraft Exchange

New York—Aircraft Exchange, formed along cooperative lines, was activated here last week for sale and lease of transport aircraft, with Capital Airlines as its first member.

Capital said it joined the group as a move toward selling its 12 Lockheed 049 Constellations; six have been unused since the airline purchased Vickers Viscount turboprop transports. Aircraft Exchange said it would begin operations on Jan. 6.

The Exchange, headed by Robert I. Helliesen formerly in charge of economic and market planning for American Airlines, also will set up an affiliate corporation to provide financing, insurance, maintenance, overhaul, and ferrying services.

Organized along the lines of a stock exchange, the group's membership falls into three classes: Regular—airlines, aircraft manufacturers or corporate aircraft owners; Associate—members who may file bids for interested parties; and Service—organizations or individuals who want regular Exchange market reports. Helliesen said the Exchange will accept quotations until 3 p.m. Tuesday of each week, when market will close.

He added that the Exchange will limit its net earnings, after taxes, to 5/10 of 1% of the first $10 million of transactions; 4/10 of 1% of the second $10 million and down to 1/10 of 1% for all business over $50 million. Exchange income above the limited profit and expenses will be refunded to regular members in proportion to the total amount of commission deposits paid by each during the fiscal year.

Helliesen said he owns 25-30% of the Exchange stock; another major stockholder is Edward A. Merkle, president of Madison Fund, Inc. Exchange officials predict a $50 million gross next year, with more than half the business expected to be done overseas. A London office will be opened this month by Charles Biondi, Exchange vice-president.

Space Technology

NASA Takes Over Jet Propulsion Lab

By Ford Eastman

Washington—Transfer of functions and facilities of the Jet Propulsion Laboratory in Pasadena, Calif., from the Army's jurisdiction to the National Aeronautics and Space Administration was ordered last week by President Eisenhower.

At the same time, Defense Department announced the Army will agree to make a portion of the research and development capacity of the Army Ballistic Missile Agency at Huntsville, Ala., available to NASA.

The space administration originally had requested the transfer of both JPL and ABMA's research and development division after a review of all military space facilities available.

T. Keith Glennan, NASA administrator, estimated that, if NASA had to develop facilities equivalent to JPL's, an investment of more than $60 million would be needed. In addition, a supporting staff of between 2,000 and 3,000 persons would have to be recruited.

Building and staffing such a complex, Glennan said, would require from three to four years.

Facilities at the Jet Propulsion Laboratory, which is operated by the California Institute of Technology, are valued at more than $55 million. There are now approximately 2,300 scientists, engineers and supporting personnel employed at the research center.

Established prior to World War II, JPL has pioneered in solid rocket propellants and has been active in the development of missiles and guidance systems.

It developed Army's Corporal tactical missile and is currently completing the Sergeant, a follow-on project to the Corporal.

Under the President's order the transfer will become effective immediately although the Army will continue, under existing contracts, certain military projects through 1959.

Operating Concepts

Operating concepts agreed to between the Army and NASA in the transfer are:

- **NASA will provide for the** general management and technical direction of JPL, except for projects relating to military operation and weapon system development programs.
- **During 1959, Army will** continue its contractual relations for continued effort by JPL on the Sergeant guided missile program, special intelligence investigations, communications research and aerodynamic testing and research. These activities are expected to be largely terminated in 1959, but, if it is necessary to continue them longer, arrangements will be accomplished by mutual agreement.
- **Army will transfer $4,078,250** to NASA for the general research program for the first half of the year. Additional funds for this program during the last half of the year will be provided by NASA.
- **Army liaison group** may be established at JPL to provide direct and continuing exchange of technical information on supporting research to help Army carry out its activities.
- **Management and direction** is transferred from Army to NASA immediately, but an orderly transfer of records and accountability for the facilities and equipment will require some time. Planned goal is to complete the transfer by Dec. 31, 1959.

Army Services

NASA may ask Army to provide on a non-reimbursable basis certain administrative and logistical support during 1959. Support functions can include:

- **Assistance in pre-award** contractual activities such as negotiation, price analysis, financial and legal services, contract clauses and conditions.
- **Audit services to be rendered** by the Army Audit Agency in connection with contract performance and determination of allowable costs.
- **Administrative supervision of** contractors' maintenance of property and cost accounting records and advice as to whether management systems employed by contractor are adequate and in accordance with contract provisions.
- **Administrative services in connection** with contractor's safety and security programs under contract standards.
- **Exercise of such administrative** controls over the performance of contracts "as may be delegated by NASA and accepted by the Army."
- **Such other support services** including litigation and proprietary rights matters.

Original Plan

Original plan to transfer Army Ballistic Missile Agency to NASA was protested by Army on the grounds that it was essential to the defense mission. The final agreement, making facilities available to National Aeronautics and Space Administration without transfer of personnel, specifies that:

- **Commander of the Army** Ordnance Missile Command will have authority to utilize ABMA resources to accomplish assigned NASA projects.
- **Key ABMA personnel can serve** on technical committees under the chairmanship of NASA, or on advisory groups, or serve as individual consultants to assist in the development of broad requirements and objectives in space programs and assist in determination of specific projects and methods by which NASA may accomplish its over-all objective.
- **NASA may place a small staff** in residence at ABMA to provide for exchange of information on assigned projects as well as exchange of information on supporting research in the entire missile and space field.
- **On request by NASA** in connection with projects funded by the space agency, the prime and subcontractor facilities of the Army in weapon systems and other programs, will be made available. In addition, resources of other elements of the Army, available to the Army Ordnance Missile Command on a direct basis will be used as deemed necessary.
- **Commander of Army** Ordnance Missile Command is responsible for scheduling the activities under his control to meet the priority requirements of NASA "in a manner consistent with over-all national priorities." He also is responsible for anticipating in advance any possible conflict in the commitment of NASA's effort and defense programs and for providing a report to both for the purpose of resolving such conflicts.

NASA Satellite Plans

Washington — National Aeronautics and Space Administration, working with the Army Ballistic Missile Agency, plans to launch eight satellites during the coming year using Juno II vehicles based upon a Jupiter booster with the second, third and fourth stages composed of clustered solid-propellant rockets, probably modified Sergeants.

Other NASA projects to be conducted in cooperation with ABMA include two lunar probes and the launching of a 100 ft. sphere.

The sphere launching is scheduled early next year.

Discussions are under way with ABMA for an additional eight or ten Redstone missiles to be used as launching vehicles. NASA also is considering the Army Missile Agency's proposals for deep space probes beyond the moon.

AIR FORCE missiles will be serviced from this 122 ft. tower now being completed at Vandenberg AFB, Santa Maria, Calif. Tower is 52 ft. wide at its base, 28 ft. wide at the top, and can be moved by rail 280 ft. when the missile is ready for launching from the pad. Service platforms are installed at 18 locations; 15 are movable by independent motors. Tower was built and installed by Vinnell Steel Co., Los Angeles.

Space Technology

Defense Plans Satellite Launches On Once-a-Month Basis in 1959

Washington – Defense Department will attempt to launch a satellite vehicle practically every month of 1959 in a satellite operation and recovery research program designated "Project Discoverer."

Roy Johnson, director of the Advanced Research Projects Agency, said last week the first attempted Discoverer launch will be made late this month or early next year from Vandenberg AFB, Calif., and will be fired to the south. The shot will follow shortly after a Douglas Thor intermediate range ballistic missile is fired to open the base and give the range instrumentation network its first full test. Lockheed Aircraft Corp. is prime contractor for the first Discoverer vehicle.

The Discoverer program was split off from the WS-117L Sentry program, which at one time included virtually all of the Air Force's space flight projects. Discoverer experiments will be of a general nature, with the data applicable to many future space vehicle projects.

One of the first research goals is to perfect methods for returning a satellite to a predetermined landing area of about 200 sq. mi. Discoverer satellites also will be used for orientation, stabilization, materials and biological experiments.

Present plans are to carry only mice and small primates. The biological information will be fed into the Man-in-Space Project being managed jointly by ARPA and the National Aeronautics and Space Administration. Biological work probably will not begin before fifth or sixth shots.

First Discoverer vehicle is two-stage, with the first stage a modified Douglas Thor and the second a special structure built by Lockheed and powered by a Bell Aircraft liquid-fuel rocket engine originally designed for the pod carried for the Convair B-58 Mach 2 bomber.

Total weight put in orbit by this vehicle will be approximately 1,300 lb., of which several hundred pounds will be useful payload. The whole second stage structure is integral with the payload and will orbit with it.

This first Discoverer vehicle is capable of achieving only a low altitude orbit, and some of the satellites probably will not make more than three complete revolutions around the earth.

Roy Johnson indicated that he is hopeful that these payload and orbital limitations will be raised considerably before the year is over through the acquisition of some Convair Atlas missiles for Discoverer use. Allowable payloads would then exceed 10,000 lb. and virtually unlimited altitude capability would be provided.

Johnson also said that if the proposed booster of 1.3 million lb. thrust to be developed by Army materializes, payloads of several thousand pounds will be possible. He also made it clear that ARPA has planned Discoverer as an "open-end" research program that could continue over a period of many years if funding is provided. At present, Discoverer is the largest single item on ARPA's budget. Johnson declined to state even in general terms what Discoverer costs would be. ARPA's total budget this year is approximately $460 million and early indications from the Pentagon are that it will not be raised substantially in Fiscal 1960.

The Discoverer program has been completely separated from the WS-117L Sentry program. Originally, Sentry satellites were scheduled to carry photographic, infrared, radar and other types of reconnaissance instrumentation as well as that needed for the general research work that comes under the Discoverer. In the reshuffling of names, the infrared instrumented satellites will be administered as Project Midas.

Johnson described the Discoverer program as being extremely broad and said that there were definitely no limitations as to launching locations, types of boosters that would be used or on the particular services and contractors who would perform the actual work.

Space Technology

First ARPA Satellite Launches To Seek Key to Improved Vehicle

By Michael Yaffee

New York—Advanced Research Projects Agency plans to launch several satellites during the forthcoming months for the sole purpose of learning how to build better satellites, according to ARPA's chief scientist, Dr. Herbert F. York.

Before it becomes possible to build something as complex as a reconnaissance satellite or a communications satellite, it will be necessary to develop vehicles much more advanced than the "spinning cans" lofted into the air by the first Explorers. Future satellites will have to be oriented toward the center of the earth or toward a star. Some means for doing this either during flight or before launch will be required. And once the satellite is oriented, it must be kept there by some still undeveloped stabilization mechanism.

Better power supplies will be needed to provide the momentum for orienting the satellite in its orbit and for correcting or modifying the orbit itself. Bigger and more powerful boosters and secondary stages must also be developed to get significant payloads up there in the first place (AW Nov. 24, p. 26).

The accomplishment of these various objectives is the sole justification for the scheduled ARPA satellite shoots. The satellites will not be differentiated in respect to mission; i.e., at this stage they will not be meteorological vehicles or reconnaissance vehicles, but simply satellites. They will not carry any special instrumentation unrelated to this function nor will they serve as a cover for any secret military mission.

One-Half of Program

This new vehicle development is one-half of ARPA's military space program. The other half is concerned with applications of space flight. Together they constitute the largest, in terms of budget, of the three major programs underway at the agency. The other two are ballistic missile defense (largest in terms of personnel with one-half the ARPA staff directly involved in the program) and solid propellant development. At the 40th Annual Industrial Preparedness Meeting of the American Ordnance Assn. here last week, Dr. York gave details on all three programs.

On the applications of space vehicles, he devoted most of his time to a discussion of the communications relay satellite. Of the two types, active and passive, ARPA is primarily interested in the active relay satellite. The possibilities here, he said, look tremendous in terms of signal-to-noise ratio.

The active relay communications satellite might take two forms. One of these would be a delay relay satellite which would be a low-flying vehicle with a tape recorder. Messages would be sent from the ground, taped, and transmitted from above another area by a ground signal to the satellite.

The other is the direct relay satellite which would fly very high. Messages would be directed to the satellite by a beamed antenna and immediately redirected to another area by a beamed antenna. Such a satellite could handle many channels.

In the field of solid propellants, ARPA is sponsoring fairly basic chemical research aimed at the development of new high-energy propellants which, in effect, means materials with specific impulses somewhere above 275 sec. One of the more promising approaches to these new materials, Dr. York told Aviation Week, is to develop some method for putting fluorine into a solid propellant. In addition to fluorine, it also appears desirable to pack more metals and hydrogen, possibly in the form of metal hydrides, into the fuel.

In its program to develop a defense against the ballistic missile, ARPA is taking a two-pronged approach. For the first missiles that might be aimed at the United States, the agency hopes to develop systems or components that are in existence or available under the present state of development. Essentially this means the Army's Nike Zeus and the Air Force's Ballistic Missile Early Warning System. Both systems, said Dr. York, are going ahead.

The other prong of the ballistic missile defense program consists of research and development that ARPA is carrying out and which it hopes to use as the foundation for building a defense against the next generation of ballistic missiles. This work is taking the following directions:

- **Improvement** of existing weapons and components. This means, for example, the development of radars with greater range than at present, and finer resolution and discrimination; computers which can analyze data much faster; and interceptor missiles which can fly higher and faster than current ones.
- **Basic research** on the phenomena which take place in the flight of a ballistic missile. As the missile nose cone flies through the upper atmosphere at high speeds, Dr. York pointed out, it sends out strong shock waves and the air is heated and ionized. This ionization will reflect radar waves. The interaction of the cone with the atmosphere also may produce optical and infrared signals that can be used in the detection of the warhead. Another aspect of this basic research involves study of effects such as the blast of a nuclear warhead at high altitudes.
- **Applications** of new developments in detection and interception. As examples of this, Dr. York suggested the possible use of infrared to pick up the heat waves generated by an enemy ICBM at launch and the rather exotic possibility of substituting some kinds of rays or beams for nuclear-tipped interceptors to destroy the missile.

Man In Space

York also mentioned the man-in-space program which is now under the direction of National Aeronautical and Space Administration. ARPA has and is maintaining a great interest in this program, he said, and is acting in a consulting capacity to NASA on it.

Another speaker at the AOA meeting, Maj. Gen. August Schomburg, deputy chief of ordnance for the Army, mentioned some work the Army is doing in the development of non-lethal weapons. One such weapon suggested by Gen. Schomburg was an aerosol which, when breathed by enemy troops, would make them sleepy or temporarily diminish their will to fight and resist. By way of illustration, he showed a movie in which a mouse was placed in a cage with an ordinary cat. The cat quickly grabbed the mouse and started to devour it. The same cat was then ostensibly sprayed with an aerosol such as described by the General and given another mouse. On the first pass the cat just looked at the mouse. The second time around the cat backed away. Then the mouse brushed against the cat and the cat jumped back in what appeared to be great terror. There was no indication given, however, that the aerosol bomb was ready to replace the more conventional warhead in ballistic missiles.

Dr. Norris E. Bradbury, director of Los Alamos Scientific Laboratory, mentioned the nuclear rocket propulsion program in his discussion of the laboratory and the different projects it is involved in. Originally, Los Alamos research on this program was concerned chiefly with high temperature and very pure materials. Then they decided to probe the feasibility of nuclear propulsion for rocket systems. This led to the conclusion that nuclear rockets were best suited for large payloads and long range missions and that for Atlas-type missions, chemical rockets were still to be preferred.

Little Radiation Data Gained from Pioneer

By Philip J. Klass

Iowa City, Iowa—Analysis of data from Air Force's Pioneer I moon shot revealed instrumentation troubles that have dashed hopes that the 75,000-mi.-high probe would provide extensive new information on the intense "van Allen" radiation belt surrounding the earth, University of Iowa scientists say.

What meager information has come out of the Pioneer data appears to confirm radiation intensities experienced by earlier Explorer satellites and to force upward revision of the intensities first reported from quick-look analysis of Pioneer data.

Loss of pressure in the ion chamber used to measure radiation (AW Nov. 17, p. 30), which dropped from 200 to 20 psi. between original manufacture and launch, reduced the device's sensitivity by a factor of 10. This was not discovered until after the launch, and further leakage may have occurred during flight, according to Carl McIlwain, of the University of Iowa.

Difficulties in tracking Pioneer with the British radio telescope at Manchester during the first 10,000-mi. of the flight has so far made it impossible to extract usable radiation data for this critical portion of the mission to determine location of peak radiation intensity, McIlwain says. Space Technology Laboratories is attempting to extract useful information from data during this interval.

Lowest authenticated data is at an altitude of 11,000 mi. where radiation intensity was about five roentgen per hour based upon ion chamber pressure of 20 psi. at the time of launch. (Maximum safe weekly dosage recommended by Atomic Energy Commission is 0.3 roentgen.) At 18,000 mi., radiation intensity had fallen below the signal threshold of the ion chamber which is approximately one roentgen per hour.

Although direct comparison of data from Pioneer and the Explorers is impossible because of different types of radiation instrumentation carried, Pioneer did encounter slightly lower levels than the Explorers. However, Pioneer's trajectory took it into the higher latitudes where current theory of radiation distribution predicts that intensities will be lower.

In Chicago, University of Iowa's Dr. James van Allen, in summarizing results of Explorer I, III and IV radiation data to the American Physical Society, said, "it appears likely that many important geophysical phenomena are intimately related to the reservoir of charged particles found trapped in the outer reaches of the earth's magnetic field." He cited these examples:

- **Radiation belt may be the "seat" of** a distributed ring current that encircles the earth. Perturbations of the radiation belt, due to the arrival of fresh solar plasma, may be directly responsible for magnetic storms which badly disrupt radio communications, but no detailed study of this has yet been made.
- **Atmospheric heating of all** latitudes may be the result of steady leakage of these charged particles from the radiation belt into the earth's atmosphere.

Van Allen said it was too early to attempt a definitive statement as to the composition of the radiation and its energy level spectrum, although it appears reasonable to assume that electrons and protons are the principal components. However, he said Explorer IV data suggests the possibility of another component that is considerably more penetrating than the radiation found at low altitudes in the auroral zone (AW Aug. 18, p. 32).

This more penetrating radiation might be a form of X-ray (Bremsstrahlung) produced by electrons striking the material surrounding the satellite radiation detectors. Additional flights, using more elaborate instrumentation such as magnetic spectrometers, will be required to determine physical nature of the radiation in order to establish its origin, van Allen said.

Investigation of the low-frequency electromagnetic radiation above the "F" region which can be expected from the electron components of the radiation that spiral back and forth along the earth's lines of magnetic field may also help establish nature and energy spectra of the radiation belt, van Allen added.

Van Allen advanced the idea that the composition and energy spectra of the radiation will vary with its latitude, longitude and altitude.

Due to eccentricity and shape of the earth's magnetic field, the radiation belt will be most intense at lower latitudes and at a longitude corresponding to the mid-Atlantic Ocean. There is a systematic drift in longitude of the trapped particles, with the electrons moving east and the protons moving west. (Period of drift for 1 Mev electrons at a geomagnetic latitude of 45 deg. is about 30 min.)

Van Allen believes leakage of protons from the reservoir of trapped particles results primarily from loss of energy by collision, while the dominant loss of electrons is due to atmospheric scattering.

There appears to little doubt that the aurora borealis is a visible manifestation of radiation that leaks into the earth's atmosphere at high latitudes where the earth's lines of magnetic force converge. For one thing, the radiation belt appears to terminate at about the same latitudes as the auroral zone begins. Also, nature and intensity of radiation measured by Explorers resembles that which was round at lower altitudes in the auroral zone, van Allen reported.

There appears to be correlation between intensity of radiation at lower fringes of the van Allen belt and the magnetic and ionospheric activity which also affects the auroras.

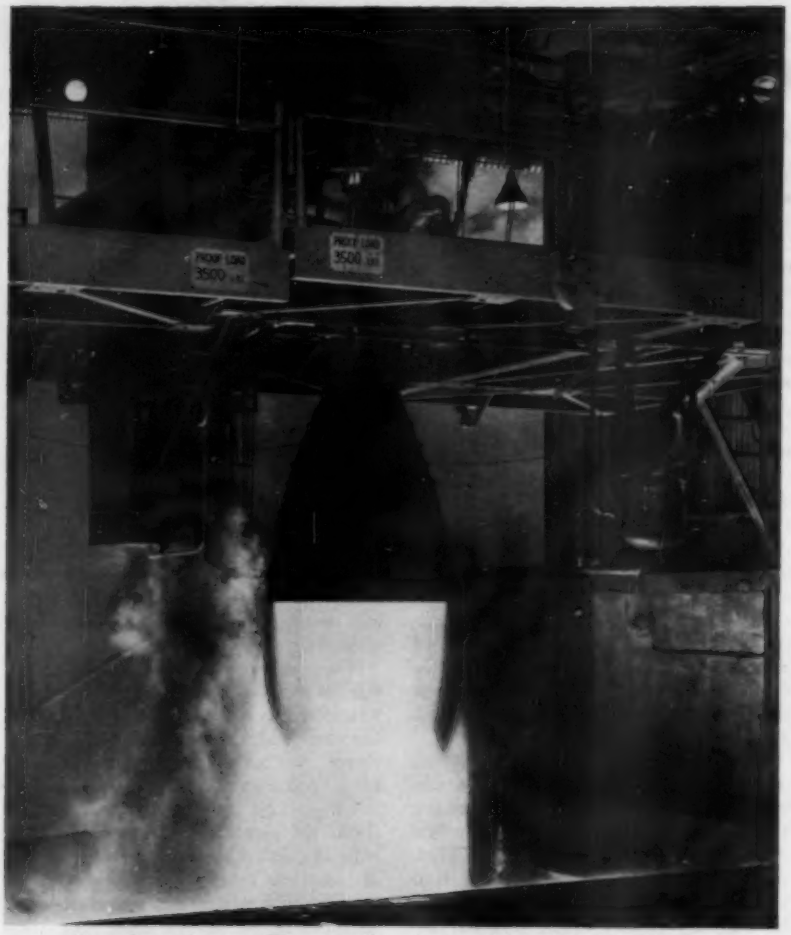
Van Allen restated an earlier theory that particles that leak through the magnetic field into the earth's atmosphere are periodically replenished by a new batch of plasma from the sun. Arrival of a new batch of gas distorts the earth's magnetic field at high latitudes, allowing increased radiation leakage into the earth's atmosphere.

Higher radiation leakage at the high latitude fringes of the belt appears to cause sufficient atmospheric heating to increase atmospheric pressure which, in turn, pushes outward the edges of the belt. If contours of constant radiation intensity are plotted, this results in horn-shaped projections at high latitudes.

Because the portion of the atmosphere which is ionized is laterally constrained by the earth's magnetic field, it is possible that there are plumes of ionized terrestial gas extending out into space like those observed in the sun's the earth's atmosphere.

USSR Concurs

Moscow-Sputnik III measurements and Soviet scientists' theories on the intense radiation belt surrounding the earth appear to agree closely with those reported by U. S. scientists, based on recent article in the Soviet press. Like the U. S., the Soviets report the earth's magnetic field retains the radiation which is several thousand times more intense than cosmic rays and increases sharply with altitude and is most intense in equatorial zone. Russians also see direct connection between radiation belt, or "halo" as they call it, and the "Polar (Northern) Lights." Russian article does not credit U. S. "grapefruit satellites" with discovering radiation belt, but Soviets do not claim credit.



Rocketdyne Tests Jupiter Liquid Engine

Liquid propellant rocket engine for Jupiter intermediate range ballistic missile is hot fired in production test at the Neosho, Mo., plant of Rocketdyne Division of North American Aviation. Rocketdyne is now delivering the Jupiter engines from its production line to Chrysler Corporation in Detroit for installation in the IRBM. Rocketdyne also produces engines for Thor IRBM at the Neosho plant.

News Digest

Joint Chiefs of Staff are weighing the possibility of merging the global communications network planned by each of the three services into a single integrated effort managed by a joint service group. Army's proposed network is known as UniCom; Air Force's network carries the project designation 456-L. Army is pushing for joint service effort, but Air Force is cool to the idea since it anticipates enough problems in coordinating the diverse needs of its own commands. Air Force is proceeding with a modest "Quick Fix" program to improve its present system and complete change-over to single side-band. Industry bids on "Quick Fix" are due this month.

Westinghouse Electric, North American Aviation's recommended choice for development of electronic countermeasures subsystems for the B-70 Mach 3 bomber, has been rejected by Wright Air Development Center following similar action on two subsystem contractors selected for its F-108 (AW Dec. 1, p. 30). Other bidders for B-70 electronic countermeasures are two teams, one headed by General Electric, the other headed by Radio Corporation of America.

U. S. Navy last week commissioned the USS Observation Island, a 17,600 ton ship specially modified for firing Polaris test missiles. The ship will operate out of Cape Canaveral, Fla., and will report test firing data to Lockheed Missile Systems Division, Polaris prime contractor.

Allison Division of General Motors Corp. and Cornell Aeronautical Laboratory are participating in a joint program of advanced missile and weapon system studies. As a first step, a group of Allison engineers will receive training at the laboratory in analysis and design problems of surface-to-surface missile systems.

Northrop Aircraft Inc. received its first USAF production order for T-38 supersonic trainer airplanes. The $16,926,000 contract is initial funding for manufacture of T-38A's, first production model of the twin-jet trainer.

Air Materiel Command's Ballistic Missiles Center has awarded a design contract for missile launch complexes to Stearns-Roger Mfg. Co., Denver, Colo. Contract is for architectural and engineering services for launching complexes at Francis Warren AFB, Cheyenne, Wyo.

British Labor Party request for a committee to check on contraction of Britain's aircraft industry last week was refused by Aubrey Jones, Minister of Supply, although the party is pressing for a debate on the subject. In addition, 70 Conservative members of Parliament have asked the government to "prevent sale to foreign powers of outstanding aeronautical inventions." Specifically mentioned was Fairey Aviation's report that it may have to seek outside support for its Rotodyne VTOL aircraft (AW Dec. 1, p. 34).

Pressurization and air conditioning systems for North American B-70 Valkyrie bomber and F-108 interceptor will be developed and manufactured by Hamilton Standard Division of United Aircraft Corp., at Windsor Locks, Conn. The two aircraft, which will operate at speeds of about 2,000 mph., will be subjected to temperatures as high as 600F, Hamilton Standard engineers said.

U. S. Air Force has contracted with Bell Aircraft Corp. Avionics Division to build an advanced version of Bell's automatic landing system, using radar to track a signal emitted from an airplane. New system will be capable of automatically landing 120 planes per hour, according to Bell, and involves sending flight path information on the radar beam, instead of by radio, as in the original version.

Sales of $27,108,550, highest in history of Piper Aircraft Corp., are reported for the fiscal year ending Sept. 30, compared with $26,615,790 for Fiscal 1957. Net income for Fiscal 1958 was $2,188,336 compared with $2,721,681 for Fiscal 1957, drop being accountable to cost of getting new Comanche in production, Piper has noted.

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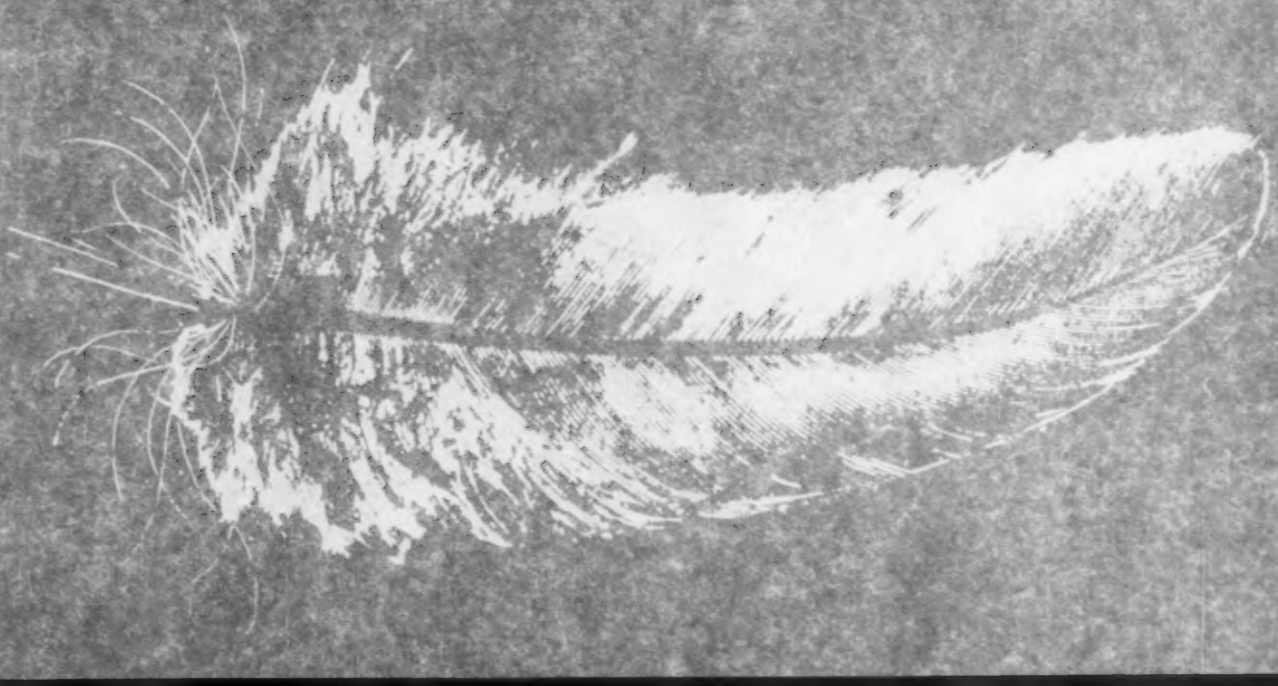

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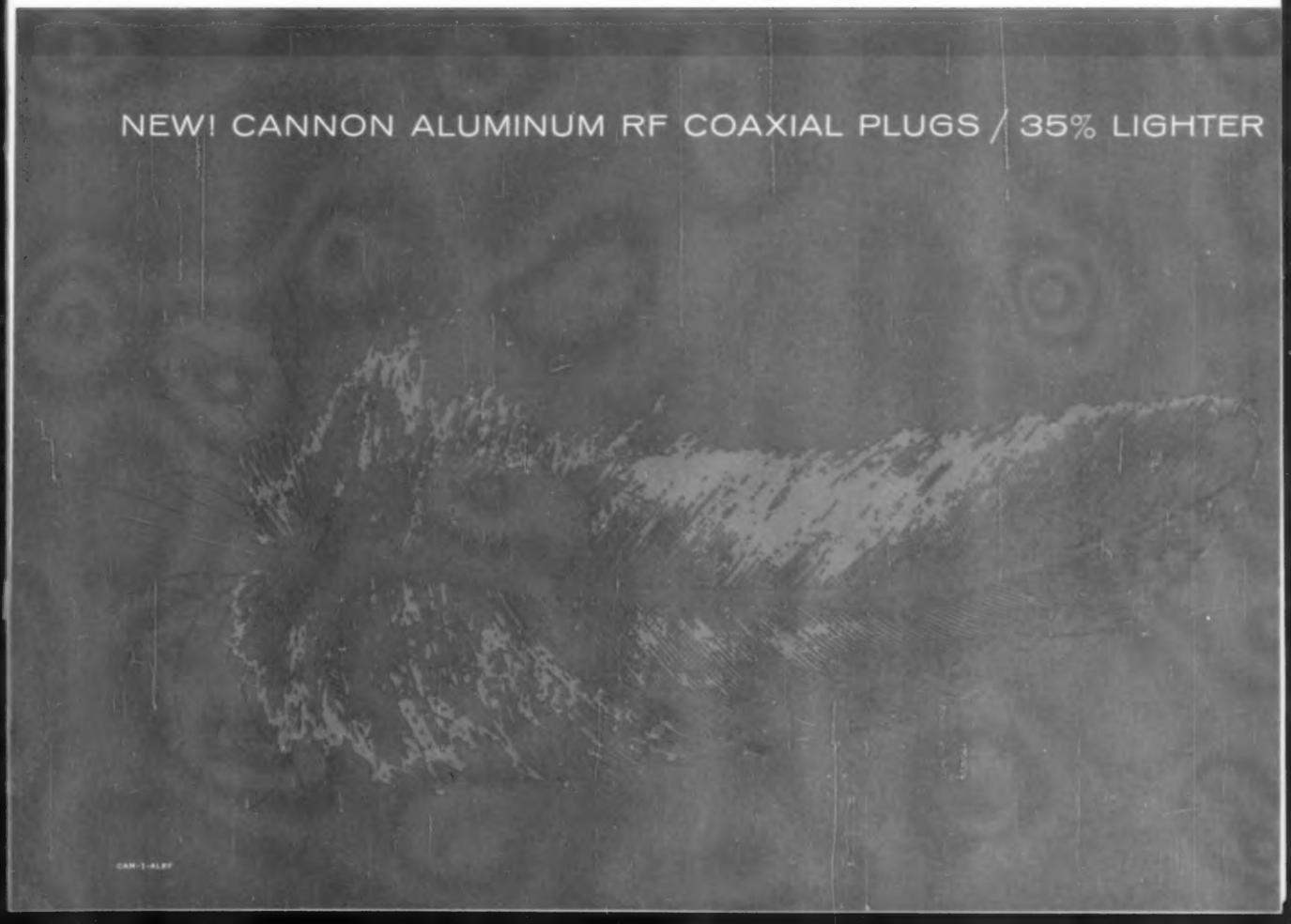

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CA58-CL28

Labor Fight Centers on Third Crewman

Eastern Air Lines, engineers deadlocked on issue as federal courts consider Eastern-American injunctions.

New York—Third crewman issue remained last week as the heart of the struggle between strike-bound Eastern Air Lines and its flight engineers despite a legal shift to other issues in the walkout.

How bitter the fight threatened to become was indicated by Flight Engineers International Assn's. intent to accept help from James Hoffa's teamsters' union if the airlines resumed operations without its FEIA engineers.

Eastern, after two attempts at mediation and further offers to the engineers, said it would have to seek other means of operating its business "if we cannot deal with the flight engineer representative in any of the ways normally employed and contemplated by law."

Out on Technicalities

The engineers, enjoined by a federal judge at Miami from striking on the crewman issue, remained out on what appeared to be technical strike issues of wages and working conditions. Meanwhile they planned to appeal the injunction covering the third man factor.

Another strike-threatened carrier, American Airlines, argued last week before a federal judge in New York for an injunction against an Air Line Pilots' Assn. walkout, stopped temporarily by a restraining order issued Nov. 24. American blamed the situation squarely on the crewman issue, but the pilots' union denied it was involved. Airline also is asking damages from ALPA of $90,000 a day for lost business due to the strike threat and will raise the figure to $850,000 a day if a strike is effected.

Trans World Airlines expected to resume operations today after reaching agreement with its mechanics to end a strike that began Nov. 21. Airline's International Assn. of Machinists personnel settled for increases of 44 cents over a three-year period.

Eastern said that, contrary to industry rumors, it was not training pilots as engineers or hiring replacements for its engineers. But it cited its obligation to other employes, stockholders and the public and advised its engineers "we cannot sit idly by while your committee spurns every effort to reach a fair and just solution" of the dispute.

An engineer spokesman told AVIATION WEEK that the engineers saw no immediate need for financial aid from the teamsters, as offered by Hoffa. In the event of operation by Eastern without FEIA, the spokesmen said, the union would call for Hoffa help on a local basis.

An example of such help would be halting gasoline deliveries by teamster personnel.

Eastern's mechanics also are on strike but negotiations are continuing. Its stewardess members of Air Line Stewards and Stewardesses Assn. are regarded by the airline as on strike, although ALSSA denies that they are.

The airline estimates the loss of wages and salaries by strike-idled employes at $8.5 million monthly. All Eastern's management personnel took a voluntary 25% pay cut for the duration of the strike.

Most TWA employes not laid off, including all management and supervisory personnel, drew a flat $300 a month as their pay during the strike. Exceptions were about 2,000 overseas personnel of other than U. S. nationality, because of the expensive complications involved in changing their pay scales. TWA estimates revenue losses of $750,000 a day during the shutdown.

Federal Judge Frederick van Pelt Bryan heard arguments last week by American and ALPA in the injunction case, and extended the restraining order at least until today. The airline contends that bargaining procedures under the Railway Labor Act have not been exhausted and that ALPA should be enjoined from striking until they are. The union objects in the first place to being in court, whose jurisdiction it challenges on several grounds, and maintains that it has bargained in good faith and complied with procedures of the act. Both sides accuse each other of bad faith in negotiations.

American's complaint also asks the court to find that ALPA's "acts and actions conditioning any new collective bargaining agreement . . . upon acceptance of (ALPA's) demand that turboprop and turbojet aircraft be manned at all flight stations by a qualified pilot in the employ of (American) as a pilot are illegal and contrary to the requirements of the Railway Labor Act." The airline insists that this issue has been the real block to constructive bargaining and is the key issue in the dispute.

ALPA, however, said the third man matter is "no part of the issues in this case as far as we're concerned." The union said "we're trying to negotiate a contract on wages and working conditions" covering piston aircraft. ALPA's position is that its piston contract, opened for negotiation in June, 1957, must be settled first or ALPA would lose a round of bargaining. It will negotiate on jet matters separately but "we want to get the present situation in hand before moving into another."

The airline wants a single contract for both types of aircraft.

Third Crewman Issue

The third crewman issue, an ALPA spokesman told AVIATION WEEK, will be negotiable in jet contract discussions with American.

Actually, the third crewman issue did not come out into the open in the court hearings here last week. Much of the discussion by counsel for each side concerned the chronology of negotiations and mediations and who did what to whom in failing to keep appointments and answer telegrams.

Judge Bryan had asked for a report on a meeting the airline said was scheduled Nov. 26 in New York with ALPA, two days before the court hearing began. American reported that ALPA didn't show up; ALPA countered that it had been waiting in Chicago, along with a mediator, for a meeting it expected on Nov. 24, and the airline

American's Crews

American Airlines pilots have received a letter from airline president C. R. Smith expressing belief that contract issues of money, working rules and conditions could be negotiated to an agreement.

"I would guess that our only real problem is crew complement," Smith wrote the airline's pilots. "We do not believe that a third pilot in addition to the flight engineer is required—and we do not feel that either you or we are benefited by spending money to teach the flight engineer to operate a small single engined airplane."

Regarding the pilot union's "inflexible" stand on the crewman issue, Smith said ". . . it would not surprise me if American pilots were asked to 'carry the flag' on this issue irrespective of what your personal viewpoint is."

hadn't appeared at the meeting.

"In other words," Judge Bryan commented, "ALPA was sitting in Chicago waiting for American and American was sitting in New York waiting for ALPA . . . I cannot say too strongly how silly the public and the court regard the performance of both parties."

Judge Bryan said he granted the restraining order solely because there seemed to be a substantial question as to whether there had been compliance with all provisions of the Railway Labor Act. An important question raised by the proceedings, he noted after the argument, was the exact definition of compliance or non-compliance, and the proof of same.

ALPA counsel Henry Weiss raised a broad issue in challenging the court's jurisdiction or power in the case. He doubted that labor legislation had given the court power to enter the dispute at all. Another objection involved the Norris-LaGuardia Act, which Weiss said left the court without power to issue an injunction in a major labor dispute. Judge Bryan reserved decision on these points, and on one involving venue (laying the place for the proceeding), but found no merit in several technical objections raised by Weiss as to the filing and serving of the complaint.

Today was the deadline for American and ALPA to file additional material in the injunction hearing. No date has been set for Judge Bryan's decision, which can come any time after noon today.

In asking judgment of $90,000 a day for the strike threat damage, American's complaint maintained that "as a direct and proximate result of the illegal action of defendants in calling, encouraging, sponsoring and threatening a strike and issuing news releases . . . plaintiff has suffered, as defendants well knew it would and intended it should suffer, a substantial damage." The airline said it was unable to assure holders of reservations or shippers that transportation would be forthcoming, and that the publicity caused large numbers of cancellations. It also cited extraordinary expenses in overtime work and loss of good will and reputation.

Gulf Widens Between CAB, Financiers

By William H. Gregory

New York—How fast the gulf is widening between the financial community and the Civil Aeronautics Board was indicated last week by a report from the Aviation Securities Committee of the Investment Bankers Assn. of America reiterating a call for overhaul of airline regulatory policies.

This report followed a talk by CAB member Louis J. Hector to the New York Society of Security Analysts in which he defended CAB policy in the face of some skeptical questions and asserted that CAB's objectives included a regulatory climate giving airline managements freedom to solve their own problems.

But it was this last point—the amount of policy making leeway actually held by airline executives—that came in for repeated criticism by the Investment Bankers' committee.

The committee report also covered the manufacturing industry, especially pointing out its problems with renegotiation and reductions in progress payments. The report noted that the problems of the airlines and manufacturers interlocked to some degree, the airlines' difficulties in financing jet transport purchases being transmitted to the manufacturers who have not yet recovered their development outlays on a cash basis. "At worst," the report said, "it (the aircraft industry) may face an unreimbursed investment in this program over $1 billion, almost equivalent to the total 1957 capitalization of the 12 major airframe manufacturers."

Fundamentally, the report delivered to the annual convention of the Investment Bankers at Miami Beach, Fla., did not differ greatly in basic analysis but from last year's report to the same convention, the report this year was much less muted in its criticism of CAB and much more detailed in specific points of conflict. These included:

• **Rate making.** "CAB historically has based its rate decisions upon a fixed maximum allowable return based upon those portions of original straight line depreciation which the board chose to recognize," the report said. "This (public) utility analogy is completely inapplicable in view of the intense competition, volatile earnings, high capital turnover, rising reproduction costs and high obsolescence factor within the industry."

• **Fare increases.** Despite industry warnings of financial need, the report said, CAB delayed initiation of the General Passenger Fare Investigation, only grudgingly departed from an untenable position against granting temporary fare increases.

• **Competition.** In the 50 heaviest traveled domestic markets, the report said, competition has increased 50% since 1955, with the average number of competing carriers per market raised from 2.0 to 3.0.

"The individual airline," the report continued, "faced with CAB-decreed ever-expanding competition, has been forced to a series of uneconomic policies —overexpansion of scheduling, capacity, advertising—just to hold its share of an increasingly fractionalized market."

To offset declining earnings and falling load factors, airlines have tried mergers and equipment exchanges, the report said. Though CAB did not block the most recent—the National Airlines-Pan American proposal—the Board does not appear to have defined any long term merger policy the Investment Bankers' committee feels might aid management.

• **Management freedom.** The committee applauded as an airline victory for more management freedom the Supreme Court decision which in effect held CAB had no authority to control airline depreciation practices. But the report criticized other CAB practices as encroachment in this area. Specifically it mentioned CAB disallowances of various airline expenditures in such categories as maintenance, flying expense, ground and administrative expense in its investigation of passenger fare levels.

• **Regulatory climate.** Financial problems of the airlines in part are a result of unfavorable regulation by CAB and in part the inherent consequence of a highly competitive industry engaged in massive reinvestment during a lull in the growth cycle, the report asserted. The size of this program between now and 1962 was placed at $2.6 billion, or three times book equity, twice total capitalization and 57 times the net income of the carriers for 1957.

"CAB rate and depriciation policies place in jeopardy the $1.2 billion which the airlines project they might reasonably raise from internal sources," the report said. "Of the $1.4 billion external capital requirements, some $510 million remained unfinanced as of early November. The unfavorable regulatory climate of the CAB as well as the unfavorable financial returns of the carriers have combined to reduce most airlines' investment status at their moment of greatest investment need.

"Most airlines will find both cost and dilution from equity financing very high until earnings reduce their downward trend and reattain levels justifying risks of the industry. Some airlines now are in technical default on present borrowings. And the high levels of present debt in many instances prevent new borrowing in the absence of additional equity investment."

The report asserted that recent CAB policies were producing exactly the op-

posite effect to what the Board was charged to do in the Civil Aeronautics Act of 1938. The committee repeated as a "matter of greatest urgency" its recommendation last year: appointment by the President of an individual to make a complete review of the Act and CAB procedures under the Act in order to re-establish constructive guide lines for regulation of the industry.

The less restrained report grew out of this sort of reasoning: a year has passed since the previous report pointed out the financial problems of the industry, yet nothing has happened. Financial men don't as a rule feel public attacks are the way to get things done so the stronger tone of this year's report is an indication of their concern.

Despite the tenor of this report, which indicates the frame of mind of Hector's Wall Street audience, most analysts felt Hector made an excellent appearance. However, most felt also that his attitude of reasonableness was not typical of the Board and that some of his opinions reflected CAB staff work that was subject to debate. CAB members previously had shown reluctance to appear before the Security Analysts (AW Oct. 6, p. 49).

Hector expounded CAB policy as designed to protect interests of both the public and the industry. Airline managements, he said, have had less and less detailed supervision from the Board as subsidies have been eliminated.

"It is my firm belief," he said, "that the amount of detailed government regulation required is almost in inverse proportion to the amount of competition in the industry. I agree in general that there ought to be less control of fares with increasing competition. But an airline can't come before the Board one day asking for less control of rates and the next day come back complaining about unfair competition or rates or service."

Hector stressed the need for airlines to tap the mass market to fill jet transport seats.

Many new discounts and many new process experiments are possible under present laws, he said, adding: "Some fares can be lowered and some may have to be raised. All these are problems of airline management and it is our duty to provide a regulatory climate in which managements can solve their own problems."

In the question period that followed, Hector was asked what the CAB's attitude was toward mergers. Reflecting the Investment Bankers' report, Hector indicated that, as of the moment, it would depend on the individual factors involved. Some of the more pointed questions:

• **CAB comment** following the Supreme Court decision on depreciation sounded as if CAB was overruling the Court. Is that CAB's attitude?

Hector denied this and replied that the Board did feel it needed a common depreciation system to deal with all carriers on the same basis. But he did not feel this system should have to be followed for tax purposes or Securities and Exchange Commission filings.

• **Northeast Airlines'** return to subsidy raised the question: Does the Board believe CAB should subsidize competition?

There have always been periods when subsidized airlines have competed against nonsubsidized carriers, Hector said, and he indicated this period of transition to jets might be another. Under the Act, he pointed out, the Board has no alternative but to pay the carrier enough to break even if the carrier is operated honestly and efficiently.

• **Is the Board** interested in a financially healthy industry or is it using its quasi-judicial role to protect the public from a too profitable industry?

Hector replied that the aims of serving the public interest and providing a healthy industry are not incompatible, and he stressed the need for a financially healthy industry.

Asked by AVIATION WEEK after the meeting whether he considered the industry financially healthy now, he answered: "Well—the third quarter looked awfully good." He added that he was impressed also by the progress airlines had been making in getting their jet equipment programs financed.

CAB Counsel Proposes Rejection Of Eastern Petition on Northeast

Washington—Civil Aeronautics Board attorneys last week proposed rejection of an Eastern Airlines request that the Board investigate the possibility of eliminating Northeast Airlines from the New York-Florida market. Eastern has asked the Board to consolidate such an investigation with the current Pan American-National lease investigation.

Noting that the Board is attempting to expedite the Pan American-National case, CAB's bureau counsel said Eastern's petition, if the CAB should decide to investigate Northeast, would transform the investigation of the joint airline lease agreement into a route proceeding, broadening its scope and delaying the outcome of the Board's final decision.

Pan American and National filed immediate protests to Eastern's proposal and the airline's allegation that the joint agreement between the carriers is a direct result of third-carrier competition in the New York-Florida market (AW Dec. 1, p. 38).

National, however, agreed with an Eastern proposal filed last week with the Civil Aeronautics Board that the Board investigate the possibility of eliminating or curtailing the authority of Northeast Airlines as a third carrier in the market. National carefully pointed out that its agreement on this point was conditioned on the investigation being conducted as a separate proceeding and not as part of the current Pan American-National Lease Investigation as suggested by Eastern.

While admitting its revenue losses from Northeast competition were "painfully true," National flatly denied allegations by Eastern that G. T. Baker, president of National, had ever stated that the airline would "sell out" to Pan American if Northeast were given the authorization for a New York-Florida route.

Eastern's arguments to include an investigation of Northeast in the Pan American-National Case, said National attorneys, are based on the "false premise" that National would sell out to Pan American, whereas National had stated only that completion of the agreement with Pan American would help offset losses resulting from Northeast competition. Consolidating the two issues would only complicate the work of the CAB and unnecessarily delay any final decision, said National.

Pan American characterized the Eastern "sell out" charge as "offensive and misleading" and told Board members that Eastern apparently thought that, if Northeast were removed from the New York-Florida market, National would regain such strength that it might not need or want any agreement with Pan American.

Northeast attorneys also denied any connection between the airline's acquisition of a Florida route and asked dismissal of the Eastern petition on grounds that CAB lacks jurisdiction to change Northeast's operating authority in the New York-Florida market before its authorization expires in 1961. The carrier also observed that "National runs instinctively and headlong into the waiting arms of Pan American whenever threatened with financial difficulty."

Northeast further claimed that Eastern had overscheduled and added too many extra flights to beat competition on the New York-Florida route during the past two years. In March of 1956, Eastern offered 1,968 daily nonstop seats on this route as opposed to 2,690 for the same month of this year, Northeast said.

Critical Airway Gaps Remain in Far East

By L. L. Doty

Bangkok—Despite rapid development of air navigation facilities throughout the Far and Middle East during the past two years, dead reckoning is still a navigational rule of thumb on many routes in these two areas.

Critical gaps in the projected chain of airways facilities are being filled as rapidly as the present Civil Aeronautics Administration's technical assistance program permits. However, inability of local governments to maintain and improve the equipment has hampered the full development of effectively-linked navigational aids.

In some areas, particularly in the Middle East, political unrest has blocked progress toward the establishment of even basic airways. As a result, no CAA technician working in these areas is willing to set a target date as to when the airways connecting the U. S. West Coast with the eastern Mediterranean seaboard will be fully implemented or operated without some CAA support.

The CAA program calls for aid in installing the equipment and the training of native personnel followed by a gradual phasing-out of CAA participation. Unfortunately, the phasing-out stage seldom materializes despite the success CAA's mission teams have met in laying the groundwork.

In many instances, personnel who have been trained by the CAA are lured away from the relatively low-paying government jobs to private industry which is always eager to latch onto trained technicians, a rarity throughout this part of the world. Consequently, CAA officials here see no real end to their training efforts.

Need for CAA Aid

Many governments are incapable of improving equipment to keep pace with the technical progress of air transportation and need the CAA assistance as an insurance against obsolescence. The $8 million airport and navigation aid project completed in Manila 10 years ago under the guidance of CAA assistance now requires the skills of another CAA mission to up-date the facilities and bring a halt to the gradual airport deterioration that has set in since the original CAA team left.

Nevertheless, navigation on international flights throughout the area is accomplished with a minimum of incidents and an outstanding safety record. At Don Muang airport here, navigational aids include a VOR, non-directional radio beacon, DME and VHF direction finder, making it one of the best equipped fields in this part of the Far East.

With two runways, 9,840 ft. and 7,360 ft. in length, it also is an important navigational link on the east-west route which is forced to swing southward in an arc through here because of the ban against flying across Communist China borders.

However, choice of routes between Beirut and Karachi varies according to the political climate of the area. Whatever the route, flight operations are conducted without the benefit of navigation aids over most of Iran, Afghanistan and Pakistan. A recently installed VOR at Karachi is now in operation, although it has not been flight checked, and is serving as a vital link on this route.

Dead Reckoning

From Istanbul to Delhi, aircraft also operate under dead reckoning procedures via Teheran and Kandahar in Afghanistan, where a modern international airport is scheduled for completion by 1960. The present runway has been extended in cooperation with a CAA mission to 6,725 ft.

Alternate airport at Kabul, capital of Afghanistan is a dirt field with a cleared runway 4,700 ft. in length. The Russians are building a large military field north of the city. It is quite possible Aeroflot, the Soviet airline, may use this airport as a refueling point on its Moscow-Delhi run. Both Aeroflot and Air-India International now stop at Tashkent on the route.

Problem in Afghanistan has been the training site for native technicians. One of the CAA's largest missions is now based in the country in hopes of creating competent staffs to handle newly installed ground facilities. The Russians have undertaken a similarly large technical assistance program, although the two groups seldom, if ever, come into contact with one another.

Pan American World Airways maintains a team of technical assistants to back operations of the Afghan airline, Ariana, and International Civil Aviation Organization is also providing technical help in the country. Despite this volume of assistance, most technical functions are still handled by foreigners although a few natives are serving as copilots on Ariana. The carrier also is using Indian Sikhs as copilots.

A total of 14 VORs are located in India and another installation is planned at Colombo, Ceylon, where a large airport project is underway. Runways at Bombay, Calcutta and Delhi—Palam Airport—have been extended and additional extensions totaling 10,500 ft. at all three airports are scheduled for completion by 1960.

A VOR is scheduled for East Pakistan but none are planned for Rangoon or Akyab where they are badly needed as navigational links across the Bay of Bengal between Burma and India. However, non-directional beacons and VHF direction-finding stations at these points permit instrument navigation into Bangkok from Calcutta.

VORS are planned by the CAA for Uboe in eastern Burma and Tourane in Vietnam. At present, the LF non-directional radio homer at Tourane and the beacon at Manila permit pilots to take a fix over the South China Sea en route to Hong Kong and to establish the "dog-leg" route necessary to avoid the Communist China island of Hainan.

From Hong Kong, aircraft are now being routed westward to the southern foot of Formosa before turning north to Tokyo along the east side of the island as a means of avoiding any military activity in the Quemoy and Matsu areas.

Formosan Facilities

Formosa is equipped with three VORs but there are no aids available for commercial use on Okinawa although transport planes pass directly over the island. According to ICAO, only the Tapei-Kagoshima airway remains to be implemented in the Pacific region plan for oceanic control area service.

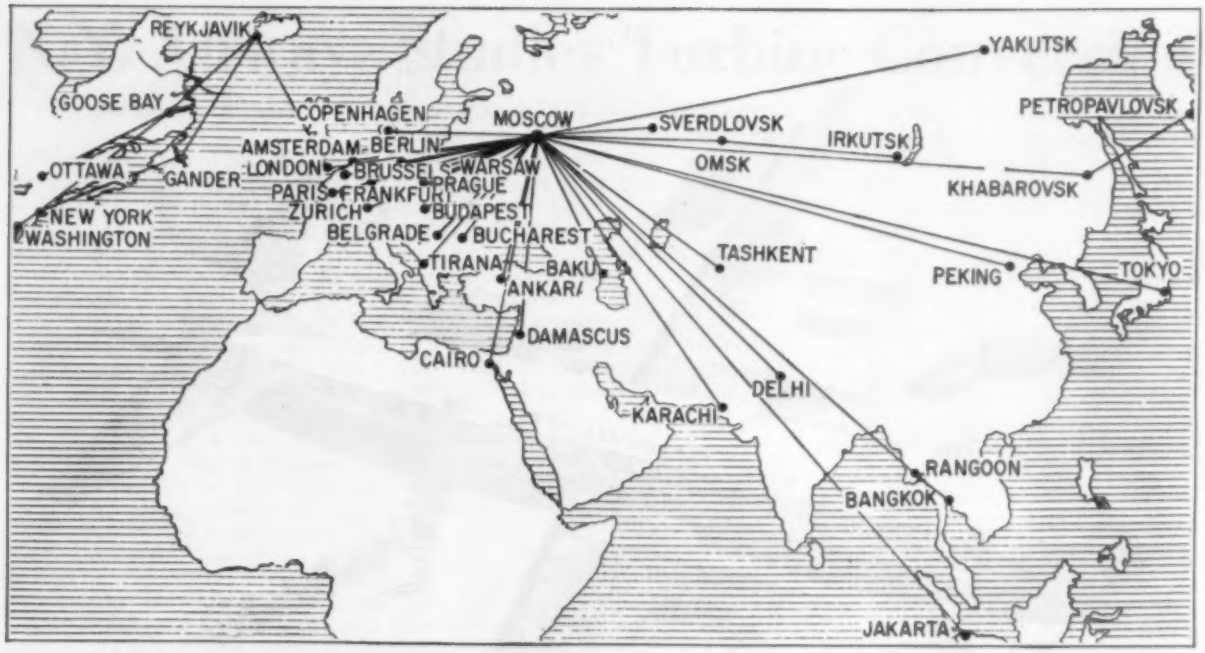
ICAO reports that it has learned the delay in implementing this segment of the route is due to objections raised by military authorities because of the strict air defense identification zone requirements.

Japan is now operating all navigation and air traffic control facilities on its own, although the CAA retains a technical mission in the country for the purposes of training and to assist in the development of an over-all civil aviation program. VOR and ILS equipment at the Tokyo airport are loaned by CAA.

The CAA also retains a training program in the Philippines and a full mission in Seoul.

Funds for the CAA missions are granted by the International Cooperation Administration and devoted solely to the development of domestic airways and airports within each country designated for the technical assistance. Facilities serving international operations are essentially a by-product of the joint CAA-ICA programs.

CAA teams act in an advisory capacity and work side-by-side in the field with native technicians as the most effective means of indoctrinating them to the jobs. Purpose of the program is to enable each country to become self-sustaining in the performance of all navi-



Cities to Which Russia's Tu-104 Has Flown

Aeroflot, the Russian airline, marked the introduction of American turbojet-powered transports on scheduled flights with this map which shows that the Soviet Tu-104 jet transport has already distinguished itself as a world traveler. The cities shown were visited by at least one Tu-104 flight during the Russian jet's first two years of regular service beginning Sept. 15, 1956.

gational and air traffic control functions required by the country. Missions normally consist of about five members who are closely acquainted with the basic characteristics of the country to which they are assigned.

Personnel chosen for CAA training must speak the English language since they are sent to CAA's Oklahoma City training center for schooling. Personnel so trained are returned to their native lands to act as instructors in developing a work core for air traffic control.

Missions are operated under the supervision of Joseph Tippetts, director of CAA's office of air navigation facilities. In addition to the missions, the CAA maintains 27 international field offices throughout the world. Field offices, to which about 300 CAA personnel are assigned, are directed by Ray Malloy, chief of the CAA office of international cooperation.

CAA has no say in the amount of money that will be devoted to aviation development. Funds for such purposes are allocated by the governments receiving the aid from total amounts granted by ICA. Much of the maintenance costs for facilities and airports are covered by landing charges imposed by the local governments.

These charges vary widely. For example, landing fees here at the Don Muang airport for a scheduled DC-6 in international service amount to $68.52 for day operations, $92.78 for night service.

BOAC Files for Bilateral Renewal

Washington—British Overseas Airways Corp. application for a renewal of its foreign air carrier permit is regarded by most U. S. flag carriers as a key issue that could open the door of the U. S. domestic air market to at least 23 foreign airlines.

As filed with the Civil Aeronautics Board, BOAC is asking a renewal of its present foreign air carrier permit along with an amendment that would allow the carrier London-to-Hong Kong authority via New York, San Francisco, Honolulu, Wake Island and Tokyo. Its application has followed closely on the heels of a similar application by Qantas Empire Airways to carry local traffic between U. S. points on international flights (AW Oct. 20, p. 46). Granting of this right to the Australian carrier would allow Qantas to carry San Francisco-London passengers from San Francisco to New York where they could be connected with another carrier, such as BOAC, to London.

Although pressure has been brought by the British government for passage of the Qantas application, it is still awaiting a legal interpretation from the Civil Aeronautics Board's general counsel who must decide whether the application comes under the heading of Fifth Freedom rights customarily granted foreign carriers or the cabotage principle which, in effect, restricts the carriage of domestic traffic within the borders of a country to that country's own carriers. Most observers feel that the BOAC filing raises the same jurisdictional questions and will have to await Civil Aeronautics Board action in the Qantas case.

Air Transport Assn., filing in behalf of U. S. flag carriers objecting to the BOAC application, has asked to be an intervenor in the case. ATA told the Board approval of the application would not only divert traffic from 16 major U. S. carriers on 25 of the most profitable air routes but also would signal a flood of similar applications from an estimated 27 foreign governments now possessing competitive rights for these route segments.

Passenger Carriage

In particular, ATA charged that if BOAC is granted its requested amendment, the carrier would concentrate on passenger carriage between points in the U. S. as opposed to its authority to carry passengers between a U. S. point and a foreign destination. The organization also said BOAC's application to serve Tokyo would not only create a heavy traffic diversion from U. S. carriers but would pose the question of proper interpretation of bilateral agreements between the U. S. and Britain.

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N.Y. Airways Studies Turbine Conversion

By Glenn Garrison

New York—New York Airways has its eye on several new helicopters now in the development stage, but a likely first move would be conversion of its present fleet from piston to turbine power, according to President Robert L. Cummings, Jr.

Next round of equipment for the helicopter airline, which recently shifted from Sikorsky S-55s and S-58s to Vertol 44Bs, will come in 1960 if the company decides its best bet is "turbinized" Vertols. Flight testing of two small turbine engines, the General Electric T58 and Lycoming T53, has been under way for some months with Vertol airframes.

Present fleet of five single-piston-engined 44Bs is now coming out of the de-bugging stage, the airline says, and has presented no more problems than would normally be expected with a new aircraft. From a maintenance standpoint, the Vertols are neither better nor worse than the Sikorsky S-55s and S-58s they replaced. Utilization is about 4 hr. 8 min. a day, the same as the Sikorskys, and this could be increased if schedules required. Engine overhaul time is now up to 500 hr. and further improvement is expected.

Cummings describes his airline as a "developmental laboratory" for commercial helicopter operation and notes that the Civil Aeronautics Administration also regards it as such. For this reason, it was important to gain as wide a knowledge of existing and potential equipment as possible before going on to the next step in development.

In this connection, New York Airways experts have been very close to the British Fairey Rotodyne program, although the aircraft is not a candidate for New York Airways routes in the forseeable future. Reason: the Rotodyne is too big and too fast for the airline's present routes, with an average stage length of around 12 mi. According to Cummings, forecast performance for the Rotodyne includes up to 200 kt. and capacity for over 50 passengers.

The Rotodyne, because its operating principle differs from conventional helicopters, offers a fruitful subject for study by New York Airways in working toward the development of an ideal craft for its routes. Extent of the manufacturer's cooperation can be seen in the fact that New York Airways' chief engineer and maintenance supervisor recently spent 12 days "in overalls" at Fairey's plant looking over the Rotodyne development.

Among the candidates that are in the running for New York Airways' next move are the Sikorsky S-61, Vertol 107, Westland Westminster, and Sud Aviation's new "Project 3200" triple-turbine craft (AW Dec. 1, p. 45). Present thinking is that if a suitable new helicopter is not available sooner than expected, the turbine-powered Vertol 44Bs would go into service in the summer of 1960, to be replaced around the summer of 1962.

The ideal machine, which Cummings for some while has referred to as "Ship X," would have a direct operating seat-mile cost of 10-12 cents, including depreciation, insurance, fuel and oil, pilot pay and maintenance.

Progress toward this goal can be seen in the figures Cummings cites for the helicopters thus far serving his airline: about 45 cents for the S-55 with five seats, 36 cents for the S-58 with 12 seats, and under 30 cents for the 44B with 15 seats. The 44B, if "turbinized," would bring this cost down to about 20 cents, Cummings said.

Manufacturers of all the new equipment claim to be within the "Ship X" costs, according to Cummings.

Use of the piston-powered 44Bs has increased New York Airways' traffic volumes. Passengers carried during the first 10 months of 1957 totaled 58,250; for the same period of 1958, the total was 73,323. The Vertols went into service May of this year.

Operational Factors

Passenger load factors for the first four full months of Vertol operation averaged 48.3%. Load factors with the S-55s ran about 52% (with only five seats to fill); the S-58s averaged about 40%. Cummings expects the Vertol load factor to reach 50-55% next year.

A handicap in the piston operation is the effect of humidity and temperature on capacity. Last summer loads had to be cut back to 11 passengers on several occasions because of these factors. The operation is also restricted by lack of one-engine-out capability and weather limitations. Performance factor is now less than 80%.

The airline is carrying Decca navigation equipment in its fleet under an Airways Modernization Board evaluation program (AW Sept. 22, p. 32). Redesign of the instrument panels to accommodate Decca, Cummings said, cost $90,000. The Decca indicator is located in the center of the panel.

New York Airways is planning a special, separate project within a few months to test all-weather operation. This will involve use of one additional helicopter, make as yet unspecified, to handle this work exclusively. All-weather capability is an extremely important factor in realizing the potential of scheduled helicopter operation.

Among the difficulties encountered with the 44Bs, according to Jack E. Gallagher, chief engineer and operations manager, was a design problem in the clutch. The high number of engagements per hour in the airline's short-hop operation caused a need for changing this component every 100 hr. Modifications, however, have given the clutch an indefinite life, Gallagher said. Another problem occured in the cylinders, where excessive heating developed in exhaust valve seats. Seat was replaced with a copper seat which has solved the problem, Gallagher said.

Another modification was to relocate the sonic altimeter transducer which had been subjected to excessive ambient noise in the aft fuselage. This equipment is now mounted in the nose for tests, but will be relocated amidships.

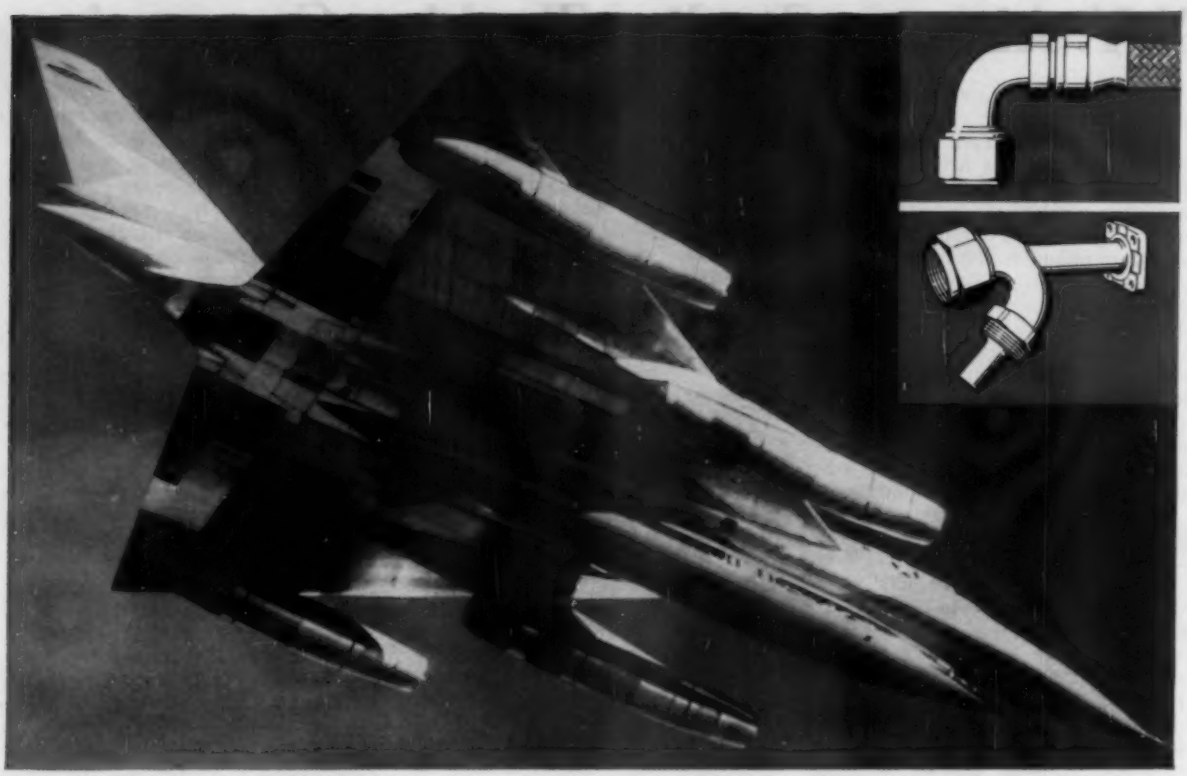
Gallagher said the airline's pilots like the Vertol, although they had a few problems before they became accustomed to it. The roll rate damper control, for example, bothered the pilots at first but they now are satisfied with it, Gallagher said. Because of its heavier gross weight, Gallagher said, the Vertol requires more flying from its pilots until they learn its advantages. Among these advantages he lists better hovering characteristics, more controllability and less cross-wind effect.

From a traffic standpoint, New York Airways likes the Vertols because they are easier to load and unload especially in view of the lack of a center of gravity problem present in single-rotor craft. Provision for carry-on luggage also is a traffic handling advantage. And passenger response to the bigger helicopters, which look like conventional airliners inside, is excellent.

About 95% of New York Airways' traffic is derived from interline agreements with most international carriers serving New York and with four big domestic airlines.

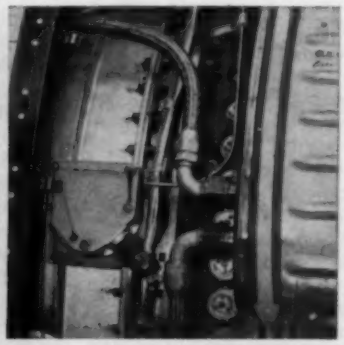
The helicopter line's present fleet provides 5½ million available seat miles a year, Cummings said. With the fleet converted to turbine power, total would go to 10¼ million.

New York Airways' "Ship X" order will be for 10-12 aircraft, Cummings said. With this equipment, frequency will increase from one flight every 50 min. to a schedule every 15 min. between the metropolitan airports served by the carrier. With the new equipment operating around a 25-mi. radius at a break-even load factor of 50-55%, Cummings said, the airline will be free of subsidy by 1963-64—within 10 years of its beginning.



Aeroquip Hose of Teflon and Tube Assemblies Simplify Installation of Power Plant Fluid Lines on B-58

This bossed tubing configuration on an Aeroquip 666 Hose Line of Teflon is connected to the engine hydraulic pump inlet.



These 666 Hose Lines of Teflon with swivel elbow fittings are installed on the lube oil tank of the J 79 engine.

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FIRST TRANSPORT to fly powered by 15,000-lb.-thrust Pratt & Whitney JT4A-3s, commercial versions of J75s, Douglas Aircraft Co.'s second DC-8 makes maiden flight at Long Beach, Calif. Leading edge slots between fuselage and inboard engine pylons are being tested on the second DC-8. External dimensions are similar to first DC-8's, which is powered by JT3C (J57) turbojets.

DC-8 Flight-Tests Leading Edge Slots

New York—Leading edge flaps are being tested on the first transport to fly with Pratt & Whitney JT4A-3 turbojets—Douglas Aircraft Co.'s second DC-8.

Boeing Airplane Co. has rolled out its first JT4A-3-equipped 707-320 intercontinental (AW Dec. 1, p. 41) and the transport is scheduled to make its first flight this week or next.

The 15,000-lb.-thrust JT4A-3 is the commercial version of the military J75 turbojet.

Douglas is testing leading edge flaps on the second DC-8 as a possible growth development to increase payload and range capability or cut takeoff and landing field length. The slots are not needed for certification of the airplane.

The 80-in.-long slots are located between the fuselage and the inboard engine pylons. The production version probably would be covered by a controllable lid during the cruise portion of flight.

The test model is covered by a skin plate which can be removed or installed on the ground.

Opinion of DC-8 buyers is divided on slots. Some whose operations are not field-length-limited would like to avoid the weight of slots. Others are eager to get them. Douglas fears it may be difficult to produce the aircraft both ways.

The second DC-8 is also testing differential use of spoilers to maintain sideslip in the wing-down crosswind landing favored by airline pilots. The airplane was originally intended to land in a crab. Ivar Shogran, DC-8 project engineer, says roll control with spoilers will seldom be used in any other circumstances because they do not begin to extend until ailerons exceed half of maximum deflection.

The second DC-8 went to Edwards AFB on its maiden flight to join the first transport on its test program. The first DC-8 is powered by Pratt & Whitney JT3C (J57) turbojets rated at 11,000 lb. thrust.

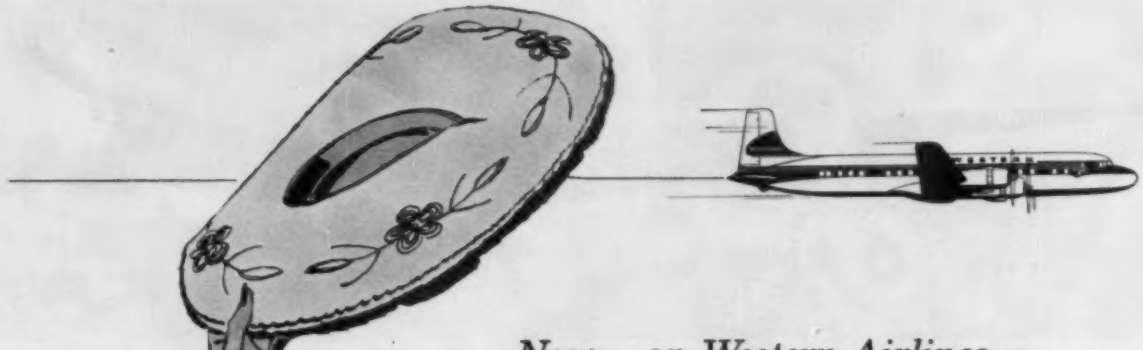
Production DC-8s three and four, both domestic versions, are scheduled to be used for Civil Aeronautics Administration flight certification tests, along with the first two DC-8s. CAA certification flights are expected to begin next month.

DC-8 deliveries begin next year; the transport is expected to enter service at the end of 1959.

Eighteen airlines have ordered 140 of the aircraft at a cost exceeding $700 million.

The second DC-8's JT4A-3 turbojets do not require water injection, which would considerably reduce jet exhaust smoke on takeoff. The British Ministry of Transport and Civil Aviation, after provisionally clearing the Boeing 707-120 for London Airport landings and takeoffs following noise tests, said that jet transport takeoffs at London will be "carefully watched" for effects of smoke (AW Oct. 20, p. 45). The 707-120 is powered by four Pratt & Whitney JT3Cs and uses water injection.

FIRST BOEING 707-320 has been painted and is being towed to the flight apron from the Boeing Transport Division plant at Renton, Wash. The aircraft is the 16th 707 to be rolled out of the plant. Engines are Pratt & Whitney JT4A-3s rated at 15,000 lb. thrust.



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SHORTLINES

▶ **British West Indian Airways** is offering new tourist fare structures permitting passengers to make circle flights to include certain smaller Caribbean islands. The new fares coincide with inauguration of daily service to nine smaller islands from San Juan to Port of Spain using Douglas DC-3 aircraft.

▶ **British Overseas Airways Corp.** will send a survey team over the airline's planed route extention from San Francisco in the near future. The new route will be an extention of BOAC's London-New York-San Francisco operations and will include Honolulu, Tokyo and Hong Kong, pending Civil Aeronautics Board approval. The airline will use Bristol Britannia 312 aircraft.

▶ **Irish Air Lines** has taken delivery of two Fokker Friendship aircraft for operation on its European networks sometime in December. The airline will receive five more of the Dutch airplanes by April, 1959, to replace its Douglas DC-3 aircraft on scheduled flights to the continent.

▶ **KLM Royal Dutch Airlines'** 1959 summer schedules call for 31 transatlantic flights per week with two daily nonstop Douglas DC-7 flights out of New York to Europe. The carrier also plans to serve Houston with as many as five services per week to Montreal and nonstop to Europe. KLM will operate 14 Lockheed Super Constellation economy class flights weekly from New York and will feature new westbound schedules calling for morning departure from Amsterdam's Schiphol Airport in DC-7 aircraft nonstop to New York.

▶ **Lake Central Airlines** has received subscriptions for the total issue of $300,000 for the 6% convertible debentures of the airline. The airline says it has now completed the first phase of a two-step refinancing program, the second being loans from financial institutions, a portion of which will be secured by mortgages on flight equipment.

▶ **Lockheed Electra turboprop** transport has returned to the company's Burbank, Calif., plant after covering some 52,000 mi. during an eight-week demonstration tour of the U. S., Canada, Europe, Asia and the Middle East. The aircraft appeared at most major cities in Europe and the Middle East.

▶ **Los Angeles Department of Airports** reports a net profit of $2,029,411 from the operations of Los Angeles International Airport and Van Nuys Airport during the fiscal year 1957-58.

AIRLINE OBSERVER

▶ Watch for an expansion of international routes by the Polish airline, LOT, coupled with a decrease in domestic route mileage. During the past year, international operations have shown a profit but domestic routes, particularly those not serving Warsaw, have been operated at a large loss. The carrier is hoping to add more modern equipment to its fleet as a first step toward expanding international routes into West European countries. LOT officials are continuing to study the Vickers Viscount as part of the airline's re-equipment program (AW Dec. 1, p. 36).

▶ **United Air Lines' suggestion that as many as 283 copilots who may be furloughed be allowed retroactive seniority protection of the flight engineers' seniority list may bring a strike against the company by Flight Engineers International Assn. if placed on the bargaining table as a demand. However, any strike date will not be effective until April or May.**

▶ Capital Airlines' lease of three Viscount 812 turboprops from Continental Air Lines (AW Dec. 1, p. 35) has been approved by the Civil Aeronautics Board. Rental fees per aircraft are $25,405 per month, $10.50 per engine hour and $3.64 per airframe hour. Capital is responsible for routine maintenance, insurance, overhaul and repairs.

▶ **Cornell Aeronautical Laboratory is undertaking studies of airborne warning indicators in an effort to evaluate the full effectiveness of such devices in avoiding midair collisions.**

▶ Russian Premier Nikita Khrushchev has called for a "six-fold" increase in airline passenger traffic under the USSR's newly-announced seven-year economic development plan (1959-1965). Other goals include "building and rebuilding over 90 main line airports, broadening the network of local airfields and modernizing air navigation aids."

▶ **Enforcement proceedings by International Air Transport Assn. against member carriers cost the airlines $320,250 in 1957.**

▶ European countries are considering organization of an agency similar in scope to the Civil Aeronautics Board as a necessary means of monitoring the allocation of routes within Europe. Such an agency is also being considered in England by the Transport and Civil Aviation Ministry to permit a wider range of operations by privately-owned airlines. International airlines will organize an operating agency similar to the Civil Aeronautics Administration to control and direct the installation and operation of navigational aids throughout the world.

▶ **Northwest Airlines will discontinue its Minneapolis-Miami interchange with Eastern, and Capital will drop its Florida interchange with National Airlines when service to Miami is inaugurated on routes recently awarded to Northwest and Capital.**

▶ Civil Aeronautics Administration has contracted with Federal Electric Corp. for the installation and testing of ground Vortac facilities. Under the contract, FEC will provide as many as 40 teams of electronic engineers to install and test the Vortac equipment as it is delivered to the CAA.

▶ **Ozark Airlines has placed an order for three Fairchild F-27 turboprop transports at a cost of $2 million with scheduled delivery in June and July.**

▶ Civil Aeronautics Board has proposed an amendment to civil air regulations that would require the use of high-visibility paints on certain surface areas of all civil aircraft. Industry comments on the proposed regulation must be submitted to the Board's Bureau of Safety by Jan. 15.

▶ **Civil Aeronautics Administration is testing three types of approach angle indicators at its Indianapolis Technical Development Center, including the Australian-designed Precision Visual Glidepath, now being installed at a number of Australian Airports for long-term evaluation tests.**

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Latest military helicopter achieves new standards of performance; carries Bristol's extensive experience of power transmission into twin-rotor field.

The Bristol 192 introduces significant advances in twin-rotor flight. Extremely efficient performance; completely reliable on one engine only; a markedly satisfactory power/weight ratio.

It offers a high degree of serviceability. For Bristol's long experience of helicopters, particularly in the vital areas of power transmission and rotor-head design, has been embodied in the 192, to give reliability and ease of maintenance beyond that of any competitor.

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Ordered for the RAF, the 192 has been designed to meet military requirements, including the ability to lift 25 troops, or 6,000 lb distributed freight.

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safety and serviceability

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Spacecraft Structural Factors Studied

By Michael Yaffee

New York—Future spacecraft will probably bear greater structural resemblance to a chemical vessel than to present-day aircraft.

Space vehicles will be constructed largely of extremely thin-wall, pressure-stabilized shells. Special characteristics, particularly light weight, demanded in all stages of these vehicles will require major advancements and unprecedented refinements both in structural engineering and in materials development, according to the predictions that were made by leading structural engineers at the American Rocket Society annual meeting here.

Some significant structural trends are already emerging in the current transition from manned aircraft and aerodynamic missiles to ballistic missiles, according to Dr. George Gerard, assistant director of research at New York University College of Engineering. Among those he considers of major importance is the manner in which the more vital design parameters are changing.

Tension Considerations

In present aircraft and aerodynamic missiles, tension considerations govern, on an over-all average, one-third of the airframe structural weight while compression and shear buckling are the prime determinants in the design of the remaining two-thirds. In ballistic missiles, where a large part of the structure is in the form of pressure vessels, roughly one-half of the weight is governed by tension and the other half by buckling considerations. In space vehicles, where an even greater use of pressurized shells is anticipated, tension forces are expected to decide the design of two-thirds of the airframe structural weight and compression and shear forces the rest.

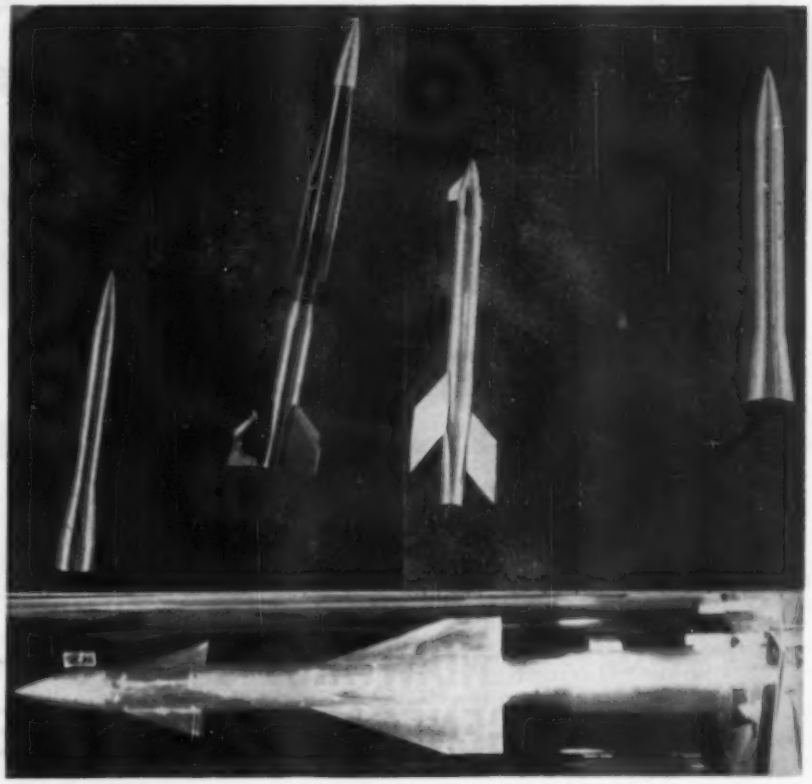
Accompanying this rise in tension structures is a growth in the use of sheet materials. In aerodynamic vehicles, sheet products account for 70% of airframe weight. The figure has gone to 80% in ballistic missiles and will probably go to 90% in spacecraft. Extrusions and forgings, Dr. Gerard said, will play a correspondingly diminishing role.

Another significant structural trend apparent in the transition from manned aircraft to spacecraft is the rising growth factor; i.e. the rate at which takeoff weight changes as a result of a marginal variation in total weight. The growth factor for ballistic missiles, according to Dr. Gerard, is about 10 times that for manned aircraft and cancels out the advantage of the missile's reduced airframe weight-to-gross-weight ratio.

Marginal Weight

In space vehicles, the growth factor becomes even more important. For an earth-Mars orbit by a four-stage chemical rocket, described by Dr. Paul E. Sandorff, associate professor of aeronautical engineering at the Massachusetts Institute of Technology, the growth factor for marginal weight in the last stage is about 44,000. Under such circumstances, Dr. Sandorff said, it would be economical to fabricate the last stage of solid platinum at $2,000/lb. if only an ounce of weight was saved for every pound of platinum used. For other types of rockets on other space missions, the growth factor would be considerably less but still significantly greater than in modern, high performance aircraft.

While warning that the still large gaps in fundamental data on environmental factors such as cosmic rays and their effects prevent precise definitions of the problems or their solutions, the



Grumman Displays Missile Studies

Grumman Aircraft displayed these wind tunnel test models, representing typical studies of air-launched guided missiles for accelerated program in this field, at American Rocket Society's Astronautical Exposition. Not all configurations represent complete missile arrangements. At bottom is a recent active project, tested at Cornell Aeronautical Laboratory, comprising solid-propellant first-stage boosters; second stage consisting of a rocket-powered cruciform missile with delta canard control surfaces. Folding fins are fitted at rear of boosters. Three wingless configurations (above) are typically hypersonic layouts employing body lift for maneuverability and body flare for stability. Canard layout (third from left) is an inherently simplified study considering discrete values of Mach number and altitude for a given combination of bow-plane setting and thrust level, eliminating need for guidance and minimizing stabilization requirements. Second from left is a rocket-powered cruciform missile model with low aspect ratio wings and interdigitated control surfaces attached to solid first-stage propellant boosters.

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The twin-jet T-38 pioneers a new Northrop family of low-cost, high-performance aircraft. Another member, Northrop's N-156F NATO-SEATO counterair fighter, is now being built at Hawthorne, California. Final mockup of the N-156F is shown in background of above illustration.

Both aircraft are evidence of Northrop Division's skill in creating and producing higher quality products at lower cost. With other current projects, the T-38 and N-156F illustrate a new kind of cost-conscious creativity—are results of Northrop's budget-minded management team, the unique Performance and Cost Evaluation Program called PACE, and of Northrop-developed production techniques.

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scientists went on to discuss the following factors facing the space vehicle structures engineer:

• **Transient heating,** which will reach critical values during boost and re-entry.

• **Handling and operational loads** incurred during fabrication, erection, checkout, fueling, staging, raising to orbit, rendezvous or boarding, etc.

• **External loads** which may result from environmental conditions such as aerodynamic forces, field forces, meteoritic impact and radiation pressure.

• **Inertial loads** distributed throughout the mass of the vehicle and its cargo in response to thrust forces or moments produced by rocket engine and attitude control devices.

• **Structural vibrations** which are a result of the dynamic effects involving elastic structural deformations, inertial forces of the supported and contained masses, and sources of energy such as engine thrust, control system response or aerodynamic forces. These become important as size and structural efficiency are increased because of the greater chance of resonance reinforcement.

• **Propellant sloshing,** which presents a serious design problem, and simple propellant surging, which can result in dynamic overload if thrust buildup is too fast. Dr. Sandorff believes that the first interplanetary probes will be based on existing liquid-propellant rockets such as the Atlas and Titan.

• **Radiation fatigue** which may be produced by the incidence of cosmic rays on metallic materials and by ultraviolet rays on elastomeric materials. Working on materials under stress over an extended period of time, this radiation can be expected to seriously weaken them.

• **Environmental protection** which means protection against such hazards as hard radiation and meteoroid punctures.

• **Internal pressurization loads.** There is little doubt in the mind of some structural engineers that future spacecraft will be designed essentially as large pressure vessels.

Pressurized Tankage

The tankage structure will be pressurized for propellant handling purposes, said Dr. Sandorff. Pressure also will be used to stabilize the membrane structure to prevent buckling or collapse under any type of external load and to transmit or distribute external loads into the structure. There will be pressure in the cabins of manned vehicles to provide atmospheric environment, in cargo and instrument compartments for functional purposes such as cooling, and in the propulsion system components such as combustion chambers, heat exchangers and plumbing.

Five different structural forms were mentioned as possible approaches to the construction of a space vehicle which probably could meet most of these conditions. The five forms are pressure-stabilized shells, unstiffened shells, transversely-framed shells, longitudinal stringer-framed and sandwich shells.

Dr. Sandorff favored the pressure-stabilized shell, which is the approach used on the Atlas. Except for a small region where sandwich structure may compete, he said, the pressure-stabilized shell is markedly superior to all other types for the specific purpose of carrying over-all body bending or axial compression, and the advantages are particularly great for large, lightly-loaded structures.

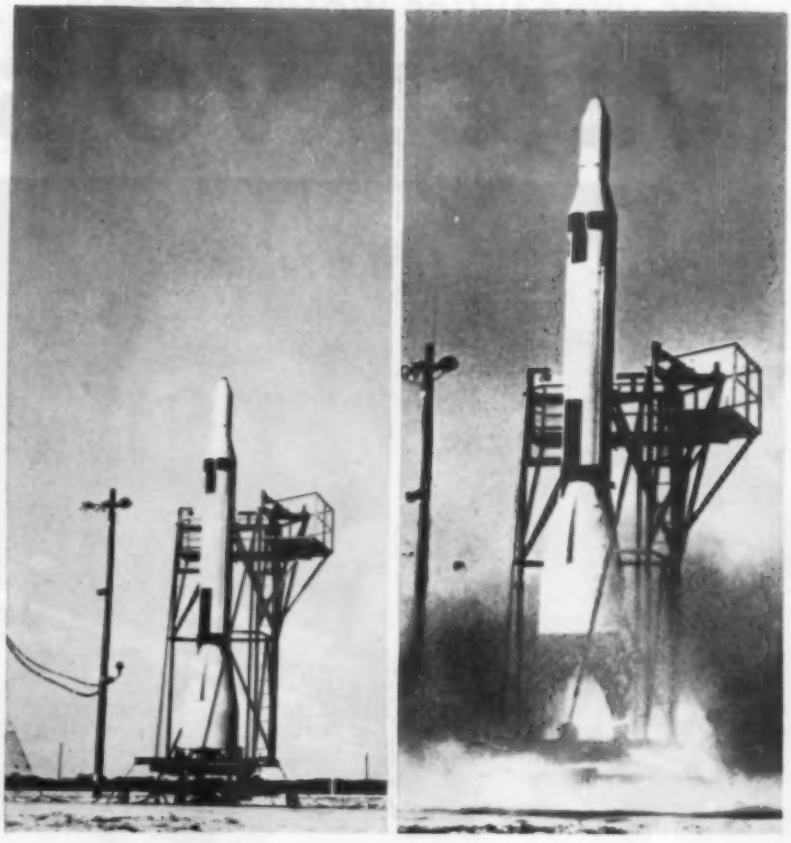
Theoretically it should be possible to extend the use of local stiffening—i.e., sandwich structure, waffle-grid structure, etc.—into the thin skin region, Dr. Sandorff noted, but this becomes a practical impossibility. In fact, the loading parameters for some present-day missiles are so low that even pressure-stabilized design may run into minimum gage limitations. Interplanetary vehicles can hardly afford the weight handicap of rigid shell structure, he believes, despite the unquestionable advantages of handling such a structure.

It appears that large space vehicles will be primarily pressure vessels, and over-all body loads will be a secondary consideration.

Dr. Gerard, who had taken a somewhat different approach to the problem, did not consider the pressure-stabilized shell, which he believes will be good only for comparatively small structures. According to his analysis of the comparative structural efficiencies of the other forms, optimum sandwich and frame stringer-stiffened cylinders are roughly of comparable efficiencies, and both are considerably more efficient than unstiffened and frame-stiffened cylinders, he added.

Vehicle Functions

The functions a space vehicle structure will have to perform are grouped by Dr. Gerard under the following four headings: load transmission, contouring, environmental protection and sealing. The requirement for satisfying all

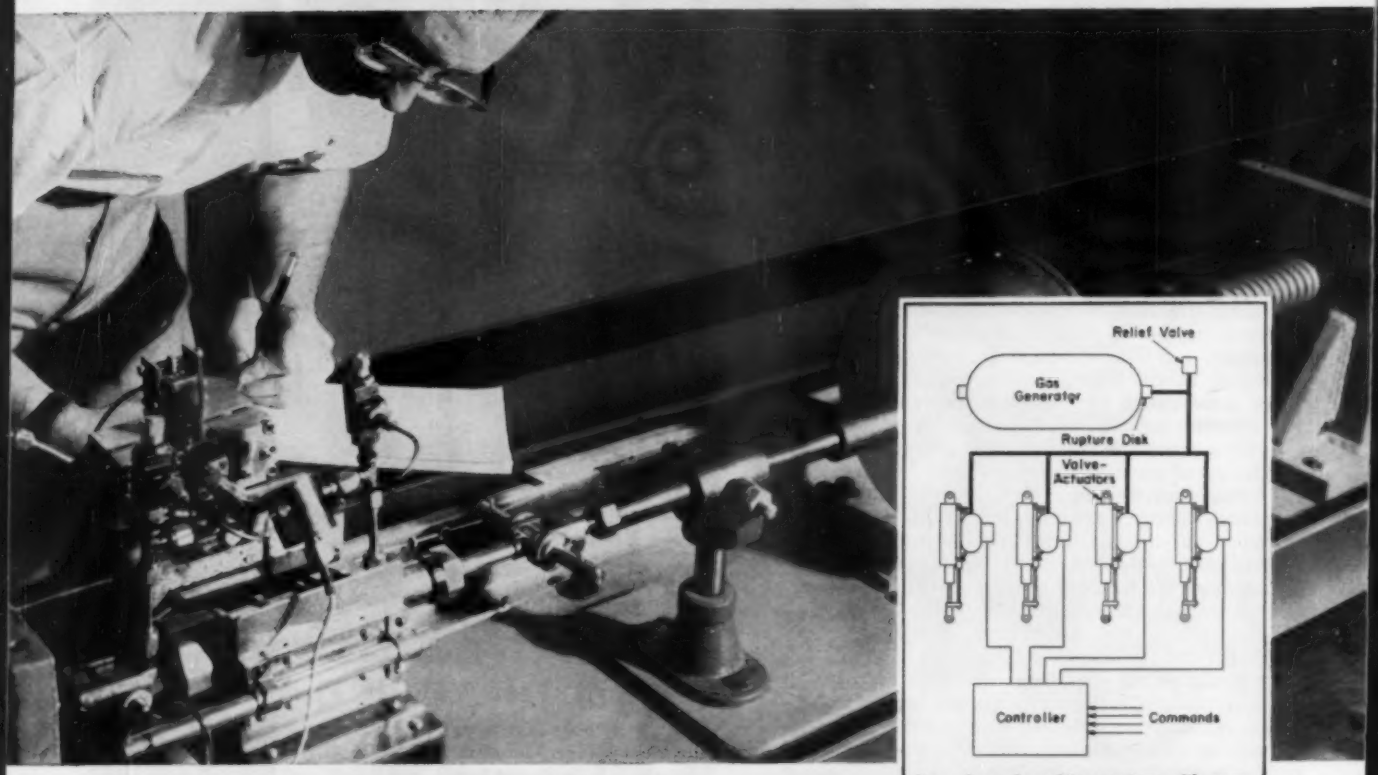


Polaris Test Vehicle Fired

Test version of U. S. Navy's Polaris fleet ballistic missile, designed to be fired from a submerged submarine, is tested at Cape Canaveral, Fla., by Lockheed Missile Systems Division technical crews. Test vehicle is shown just before launch (left) and begins its flight (right). The solid-propellant missile is on its way to the target in a limited objective test. Navy has indicated that Polaris will become operational aboard nuclear-powered submarines in 1960.

WHERE HYDRAULICS WON'T PERFORM . . .

GAS SERVO SYSTEM



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By using the energy directly, rather than converting it to hydraulic power first, the system can tolerate ambient temperatures of 750F and higher. And, by eliminating this energy-conversion step, the number of components is kept at a minimum, simplifying the design, and thus increasing reliability.

As a hot gas servo, a solid propellant is stored in a gas-generating unit that also acts as an accumulator. When ignited, the gases fill the accumulator before entering the pressure-controlled, two-stage servo valve. The bleed-type first stage regulates the pressure in the second stage. This diverts the gas to either side of the actuator to control output force.

As a cold gas servo, with air or an inert gas as the energy source, the same system reduces contamination problems in high nuclear-radiation areas. In addition, the "closed-center" type valve also offers operating economies in such a system, when using stored gas or a closed cycle in which the gas is reused.

This servo system design offers several advantages over other approaches:

1. High frequency response is possible through pressure-type control. For example: 20 cps at 90-degree phase lag, with a 250-pound load. Higher response is possible with increased control bleed flow.
2. The unit is flexible. Damping, stiffness, and accuracy characteristics are controlled electrically. No change in hardware is needed.
3. Poppet valves minimize leakage. They have no close-fitting sliding parts and are well suited for high-temperature operation.
4. Symmetry of design lessens thermal shock problems, minimizes effects of G-forces, and avoids null shifting.

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of these functions simultaneously has led to a philosophy of fail-safe structural designs in which the main idea is to design structures so that any crack which may develop in service can be contained locally to avert catastrophic failure of the complete structure.

In pressurized fuselages, the structure also performs all of the foregoing functions. Heavy frames and tension bands are used to contain any propagating crack, and the structure is fail-safe in the sense that it can still transmit loads other than pressurization. But the sealing function is destroyed.

In the fail-safe design of spacecraft, however, it will probably be essential to retain the sealing function. The possibility of micrometeorite penetration makes it particularly important: Dr. Gerard considers this need to maintain pressure another drawback to the use of pressure-stabilized shells. A promising approach to the solution of the problem, he claims, lies in the development of composite structural materials which will satisfy the load transmission and contouring functions separately from the sealing function, somewhat in the manner of the self-sealing gasoline tanks used in World War II aircraft.

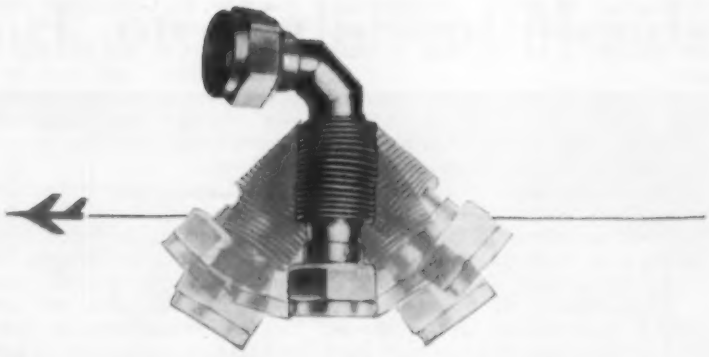
Materials Problem

Structural design problems are only part of the difficulties facing the spacecraft designer, the scientists agreed. Another important group of problems is presented by the materials the designer must use.

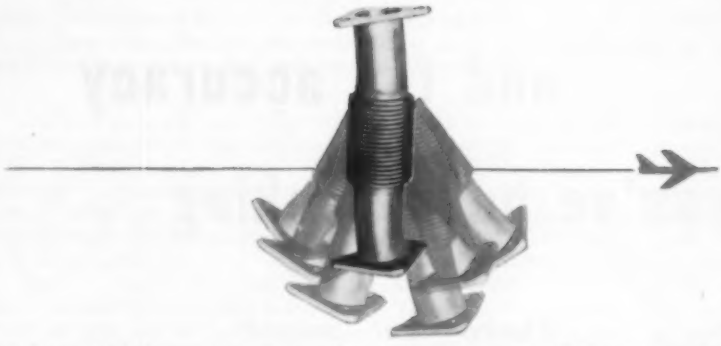
Until recently, this has not been much of a problem primarily because the aircraft designer has been able to use materials with ductilities in excess of 10% for tension structures. Now, however, the need is for materials which will maintain high strength at the temperatures encountered in the various phases of orbital and interplanetary flight. Sheet materials such as heat treated titanium alloys, precipitation hardened steels, martensitic stainless steels, hot-worked die steels, and beryllium are proving attractive. Unfortunately, Dr. Gerard pointed out, the high strength levels of these materials are presently accompanied by significantly decreased ductility.

Ductility has an influence on structural strength. The relative importance of stress concentrations in tension structures, according to Dr. Gerard, depends directly upon ductility. The greater the ductility, the greater the reduction of the stress concentration from its elastic value as the strain is increased in the plastic range.

With the increased proportion of the spacecraft airframe in the form of tension structures, the designer now faces a host of tension structural problems associated with materials of limited ductility in the range of 2-10%. The de-



FATIGUE RESISTANCE



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termination of stress concentration factors encountered in practical designs, for example, is an important problem area.

For each elastic stress concentration factor, the structural strength reaches a maximum and then with further increases in the strength-weight ratio of materials, begins to decline. This indicates an optimum strength-weight level and associated ductility ratio for materials at which the strength-weight level of the structure is maximum.

While stressing the great need for more fundamental data on the behavior of materials under the conditions they are likely to encounter in space vehicle structures, Dr. Gerard made some tentative evaluations.

It appears, he said, that high strength titanium alloys and steel of limited ductility can be used successfully in tension structures where the elastic stress concentration factors are of a relatively low level.

For compression structures, Dr. Gerard suggests the suitability of a number of materials. In stiffened cylindrical shells operating at low values of structural index, for example, magnesium and aluminum alloys will serve efficiently at temperatures up to 600-800F in short time applications. At higher temperatures and for higher values of structural index at low temperatures, the titanium alloys will have wide application.

It is interesting to note, Dr. Gerard continued, that the titanium alloys are the only materials listed for both tension and compression applications. The steels, owing to their high densities, become competitive with titanium alloys only at relatively high values of structural index—which for sandwich and frame-stringer stiffened cylinders would be a loading-density ratio somewhere above 100 psi.

But from a compressive stability standpoint, Dr. Gerard declared, beryllium looks like the best material of all for space structure applications. It is considered superior to all other materials on a strength-weight basis by virtue of its low density and high modulus of elasticity.

Future Designs

Dr. Sandorff does not peg future space vehicle designs to any specific material but believes rather that the unusually high rewards for lightweight construction will encourage the general development of "exotic and expensive materials." And, looking at the problem of spacecraft design on an integrated system basis, he foresees the need for additional engineering development in many other areas not primarily structural in nature. Among the related requirements for future space vehicle development, he listed the following:

- **Methods for controlling** or avoiding propellant sloshing and surging in large thin-walled tanks.
- **Guidance instrumentation** in large vehicles which will discriminate between flight course deviations and spurious signals arising from structural modes and fluid oscillations.
- **Purging systems** to reduce unusable propellant.
- **Gust probe** to establish wind shear profiles prior to takeoff in order to program the ascent trajectory and reduce aerodynamic loads.
- **Snark booster type Jetevators** for thrust vector control in order to avoid the space requirements of gimbal-mounted engines and associated interstage weight penalties.

But before any of this, said Dr. Sandorff, must come more complete knowledge of actual environmental conditions and their effects. Current satellites can contribute little to the knowledge of such things as meteoritic matter due to their low exposure and low altitude.

What is needed, the engineers said, are space exposure stations or satellite laboratories which will allow for the testing of materials and components under static, fatigue and creep loads while exposed to actual space environment with provision for the return of tested specimens to earth for laboratory analysis.

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DETROIT CONTROLS DIVISION

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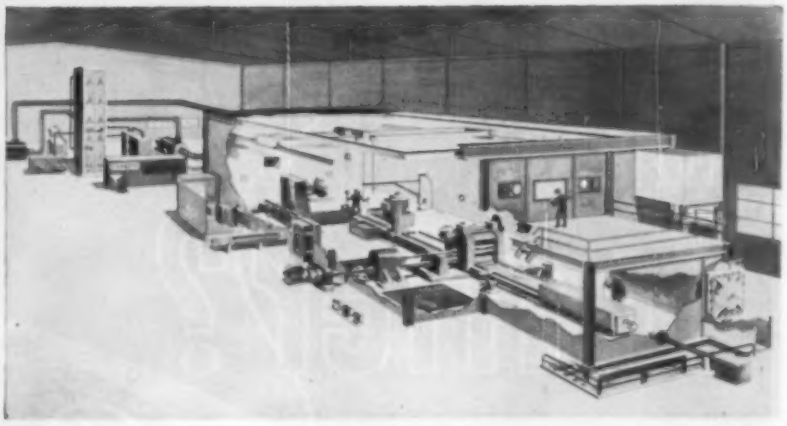
Navy Pushes Work on High-Heat Metals

New York—Universal-Cyclops Steel Corp., working under a $3-million prime contract, has placed final sub contracts for the construction of an unusual pilot metals plant for the Navy Bureau of Aeronautics. Designated In-Fab (for inert fabrication), the plant will be used to develop new fabrication techniques for hard-to-work refractory materials that are needed for extremely high-temperature service in missiles and aircraft.

At present the chief candidate for development work is molybdenum which appears to many metallurgists to be the most promising metal for service at temperatures of 2,000F and above.

Other materials under consideration include columbium, tungsten, rhenium, tantalum and their alloys. All these materials have melting points above 3,500F and possess considerable strength at high temperatures. But they are difficult to work except at very high temperatures and therefore their use has been restricted mostly to minor alloying roles rather than structural applications.

SPACE type suits will be worn by personnel who will be assigned to work inside the airtight room to develop fabrication techniques. Suit contains an auxiliary air supply in case of failure of outside supplies.



INERT gas facilities of U. S. Navy's planned In-Fab pilot plant (left rear) are shown in this artist's conception. Cutaway also shows airtight room which will be used to develop fabrication techniques for high temperature metals and alloys.

The In-Fab facility, according to the company, will permit the pilot production of the refractory metals within their true hot-working range. Temperatures 1,500F above those presently feasible in the metal working industry will be achieved.

Ideally, Universal-Cyclops says, a metal should be hot-worked at temperatures as high as 80% of its melting point where recrystallization readily occurs during deformation. For the refractory metals, this means a hot-working range between 3,000F and 5,000F or almost double that required for the conventional iron-based and nickel-based high-temperature structural materials being used today.

Hot-Working Facility

At very high temperatures, however, another problem appears and that is oxidation. At 2,400F, for example, molybdenum oxidizes rapidly, forming a smoke screen of volatile oxide that virtually obscures the material during processing.

Still another problem is nitridation —reaction of the material with atmospheric nitrogen to form unwanted nitrides.

To protect the refractory metals against oxidation and nitridation, fabrication will be carried out in an airtight room 40 x 80 x 25 ft. high. The enclosure will be provided with an inert argon atmosphere which will be maintained at a purity of 99.995% or better.

The atmosphere will be recirculated every three hours through a purification system operating at −300F which will remove air, moisture, carbon dioxide and other gases. Personnel will work short shifts and will wear air-conditioned space type suits equipped with intake and exhaust lines which connect to manifolds within the room. Each suit will also contain an auxiliary air capsule for use in the event the inlet air supply fails. There will be two "crash doors" to permit rapid exit in case of emergency in addition to a specially designed air lock for routine entry and exit of personnel. Two conventional exhaust and purge air locks will provide passage for equipment and processed materials.

The equipment within the enclosure will consist of a graphite-lined indirect induction furnace, a Birdsboro rolling mill and a Chambersburg impactor as well as the usual accessories such as lathe, shear, hacksaw and welding unit.

The impactor will break down ingots, which have been heated to 4,000F by direct induction, into billets or sheet bar.

The furnace will head the billets and sheet bar to 4,000F for rolling; and the rolling mill will convert them into rounds and sheet.

Airtight Enclosure

The airtight enclosure as well as external auxiliary equipment such as the argon purification plant will be housed within a larger building.

The facility will be constructed by the Howard P. Foley Co. under the direction of Universal-Cyclops' Refractomet Division.

Rust Engineering Co. did the engineering in the design of the plant and will continue to perform architectural services during construction. Air products, Inc., helped develop and will build the low temperature argon circulation and purification system.

Universal-Cyclops expects the pilot plant to be in operation within a year.

A darning needle or grain of sand?

E/C^2?

A singularity in a field?

A ratio of accelerations?

How is it held together?

Is there a region of anti-matter extant in the cosmos?

The nature of matter is important to Allison because energy conversion is our business and matter is convertible to energy. Thus, we have a deep and continuing interest in matter in all its forms.

Basic to our business is an intimate knowledge of every form of matter — solid, liquid, gaseous. We search for this knowledge to increase the effectiveness with which we accomplish our mission — exploring the needs of advanced propulsion and weapons systems.

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Division of General Motors, Indianapolis, Indiana

AMC Contracts

Wright-Patterson AFB, Ohio—Following is a list of unclassified contracts for $25,000 and over as released by the Air Materiel Command:

Continental Motors Corp., Muskegon, Mich., production engines for the MA-7 air conditioner and spares, Packette engines model PC 60-7, (PR MP-8-51A-20910, —1 and —2), $192,472.

The Tumpane Co., Inc., Park Ridge, Ill., services: provide maintenance of facilities at Air Force Plant No. 8, Park Ridge, Ill., for the fiscal year 1959, Oral RFP of May 16, 1958, (PR PM-9-S-6020), $505,979.

Fairchild Aircraft Division, Fairchild Engine and Airplane Corp., Hagerstown, Md., modification, ferrying, maintenance and flight test of YC-134A aircraft, (PR 23164), $43,045.

Standard Steel Works, Inc. North Kansas City, Mo., type MH-1 compressed gas cylinder semi-trailers in a/w MIL-S-4972, spare parts, technical publications and descriptive identification data (for storage, transportation of various compressed gases), (PR MP-8-2330-30010), $783,200.

Protection, Inc., Division, Mine Safety Appliances Co., Los Angeles, Calif., one sizing range of helmets in a/w exhibit WCLDF-296 to be used with both full and partial pressure suits, (PR 16214), $49,034.

National Northern Corp., West Hanover, Mass., producing forgings through the use of explosives, (PR PB-8-MMP-6174), $36,272.

Federal Electric Corp., Paramus, N. J., services required for maintenance and operation of DEW Line during fiscal year 1959, (PR PM-9-S-6046), $10,000,000.

Southern Airways, Inc., Bainbridge, Ga., operation of an Air Force primary pilot training school during fiscal year 1959, (PR PM-9-S-6016), $4,048,987.

Gardner Aviation Service Corp., Bartow, Fla., operation of an Air Force primary pilot training school during fiscal year 1959, (PR PM-9-S-6012), $4,509,073.

Pittsburgh Institute of Aeronautics, Marianna, Fla., operation of an Air Force primary pilot training school during fiscal 1959, (PR PM-9-S-6011), $4,250,326.

Anderson Air Activities, Malden, Mo., operation of an Air Force primary pilot training school during fiscal year 1959, (PR PM-9-S-6013), $3,592,715.

California Eastern Aviation, Mission, Tex., operation of an Air Force primary pilot training school during fiscal year 1959, (PR PM-9-S-6015), $3,881,868.

Hawthorne Flying Service, Moultrie, Ga., operation of an Air Force primary pilot training school during fiscal year 1959, (PR PM-9-S-6014), $3,917,667.

The Tumpane Co., Inc., Terre Haute, Ind., services: maintenance and operation of AF DIER storage site no. 7, Terre Haute, Ind., for the period July 1, 1958, through June 30, 1959, (PR PB-9-S-9007, PD-9-S-1006 and EWMT-58-3), $2,467,713.

Kaiser Aluminum and Chemical Corp., Newark, Ohio, services: follow-on maintenance and operation of Air Force Plant No. 48, Newark, Ohio, (PR PB-9-S-9003, PB-9-S-9008, and PN-9-S-9008-1), $93,038.

The Tumpane Corp., Marietta, Ga., services: maintenance and operation of AF DIER storage site no. 6, Marietta, Ga., for the fiscal year 1959, (PR PB-9-S-9006, —1 and PB-9-S-9012), $1,432,018.

Puget Sound Bridge & Dredging Co. and Johnson, Drake & Piper, Inc. (joint venturers), Seattle, Wash., fiscal year 1959 operation and maintenance of Point Barrow Camp, Alaska, (PR PM-9-S-6030), $1,000,000.

Continental Motors Corp., Muskegon, Mich., production engines for the MM-1 vehicle and spares. (PR XM-8-51A-7244 and —1), $134,115.

Douglas Aircraft Co., Long Beach, Calif., one set of prototype hardware for a cargo loading system, installation of the hardware in a C-133 aircraft and technical representation for six months, (PR MP-8-3990-20724 and amendment no. 1), $196,992.

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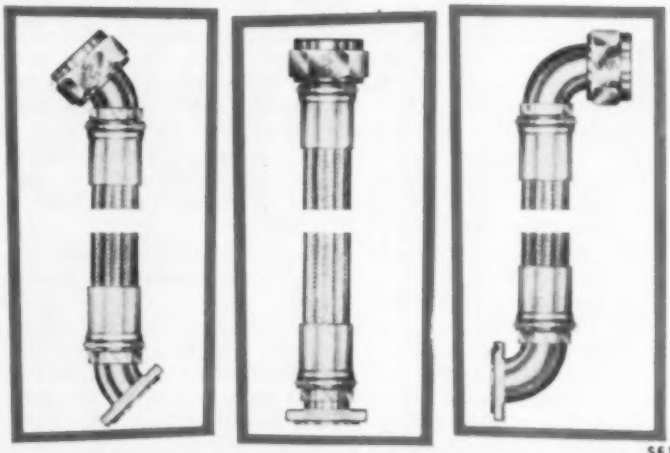

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Under the high vacuum conditions encountered in outer space, familiar products and processes which work at sea level may develop strange and unfamiliar characteristics.

For example, at extreme altitudes metal-to-metal contact may cause parts to gall or stick. Graphite lubricants lose their effectiveness. Grease vaporizes rapidly. Plastics change their properties. Some metals such as zinc evaporate directly. Rocket flame patterns change and fuels behave differently.

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Existing facilities are available in our laboratories for doing basic materials research for outer space and missile applications on a contract basis.

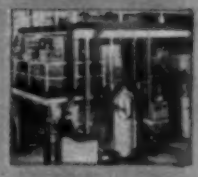
Together with our subsidiary, NRC Equipment Corporation, we can deliver a turn key installation which will simulate high vacuum conditions above 100 miles. If you wish to assemble your own high vacuum facilities, standard gauges, valves, pumps and accessories are in stock for immediate shipment. The services of our field engineers will help you save time, money and trouble.

Call or Write in today for preliminary exploration of how we can help you build products or select materials for outer space components.

Chart prepared by National Research to indicate vacuum requirements for space simulation. Data taken from International Geophysical Year Reports. Copyright 1958 by National Research Corp.

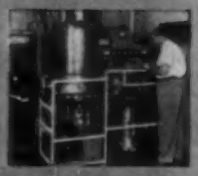
Almost weightless heat reflective or corrosion resistant metallic coatings from 2 millionths to 2 thousandths thick can be deposited on metals, plastics, fabrics, or paper. NRC can develop the coatings or supply the equipment.

A complete line of vacuum arc, induction and resistance furnaces is available to help you develop or produce new high performance metals. Services of our vacuum metallurgical department are available.

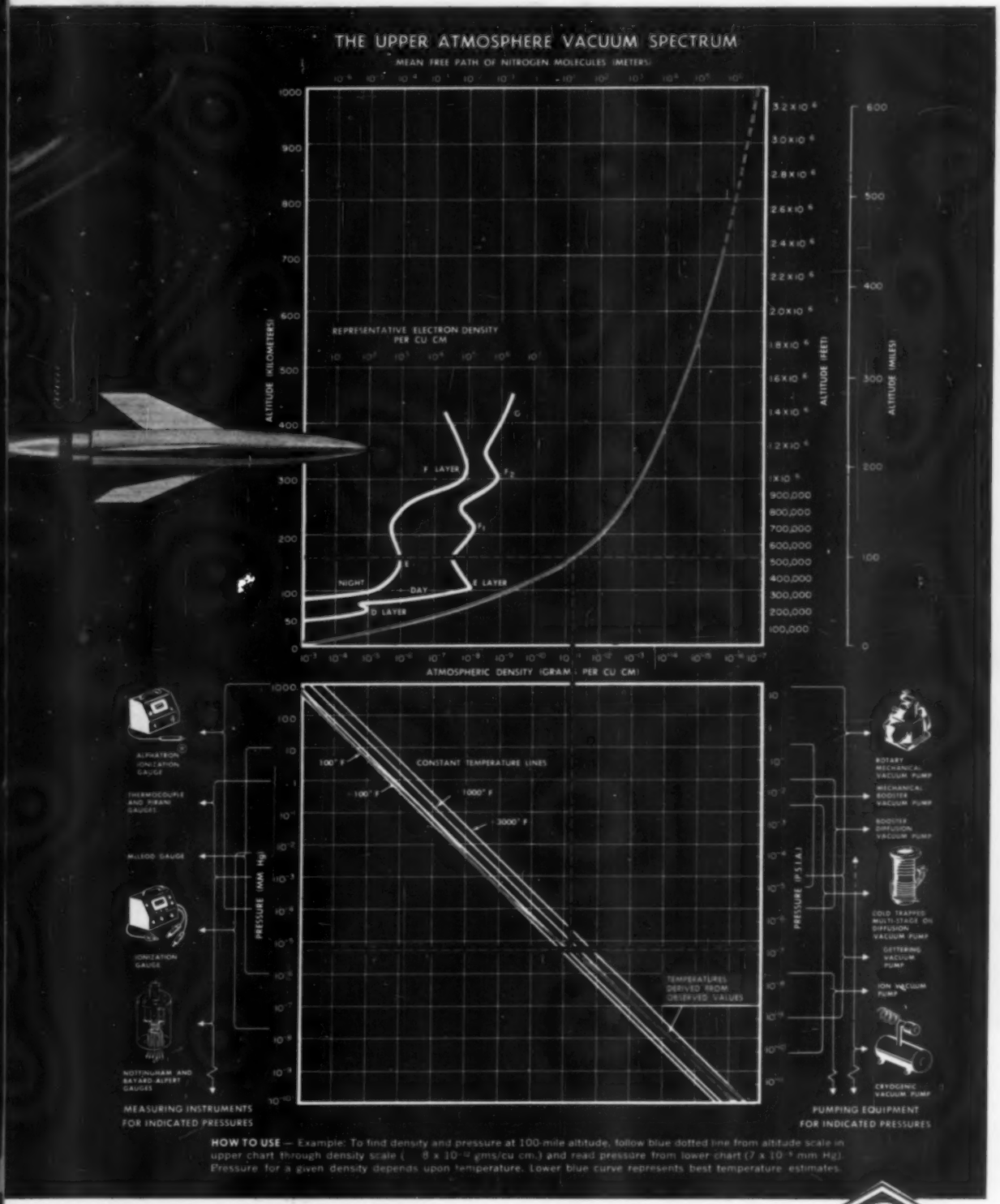


Know gas content in metals with the NRC Gas Analyzer. Hydrogen, oxygen and other gases in metals can cause fatigue or product failure under high temperatures.

Comprehensive information through NRC test facilities is available on effects of low pressures on flexibility, outgassing, slip, chemical stability, etc., of metallic refractories and plastics.



For measuring density at high altitudes the 2-ounce Alphatron® densitometer can be connected directly to telemetering equipment.



HOW TO USE — Example: To find density and pressure at 100-mile altitude, follow blue dotted line from altitude scale in upper chart through density scale (8×10^{-12} gms/cu cm.) and read pressure from lower chart (7×10^{-9} mm Hg). Pressure for a given density depends upon temperature. Lower blue curve represents best temperature estimates.

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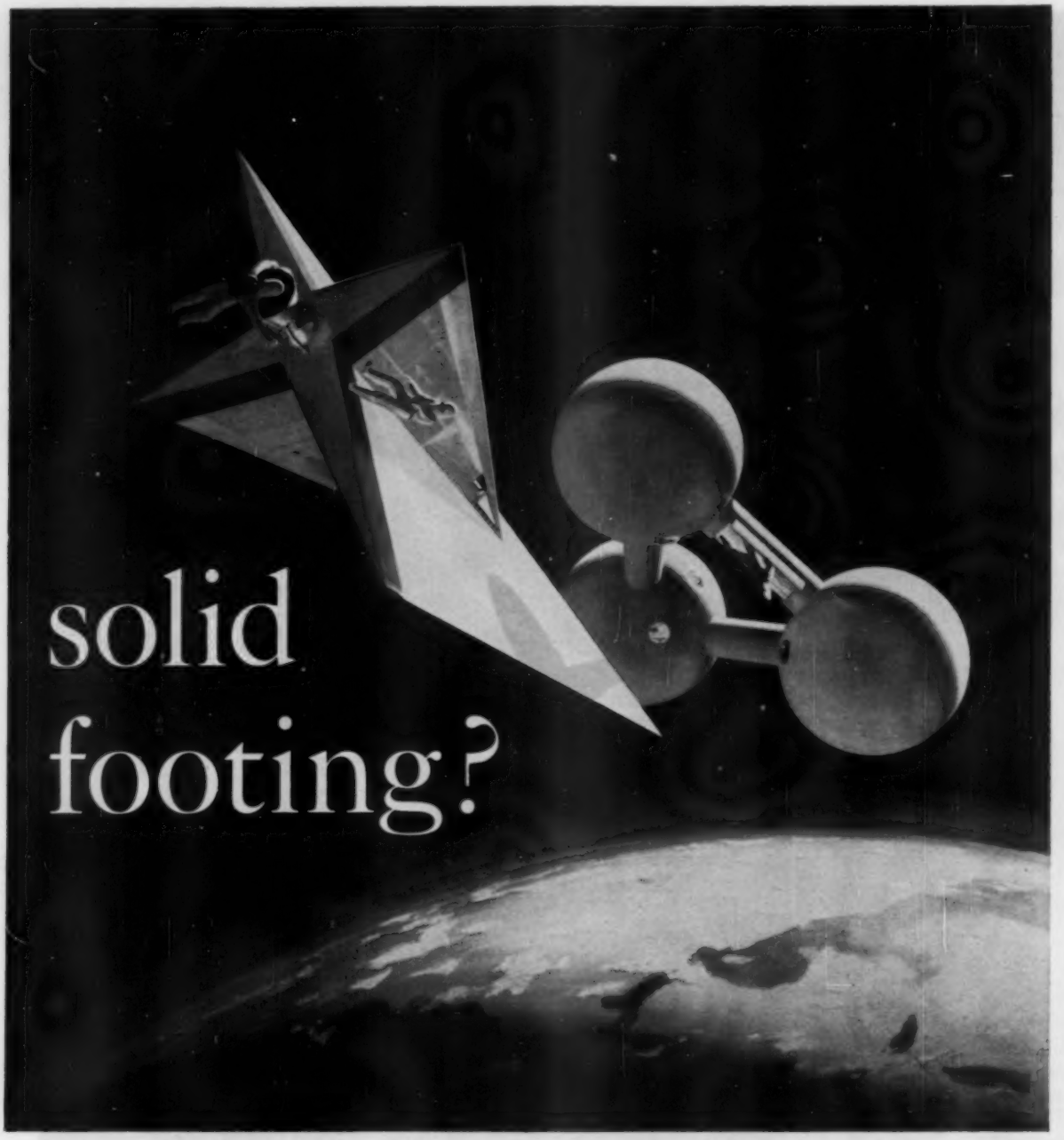

To a man floating weightless around Space Station C, these are perhaps meaningless words—but *solid footing* is highly important to most of us who live and work on the surface of the earth.

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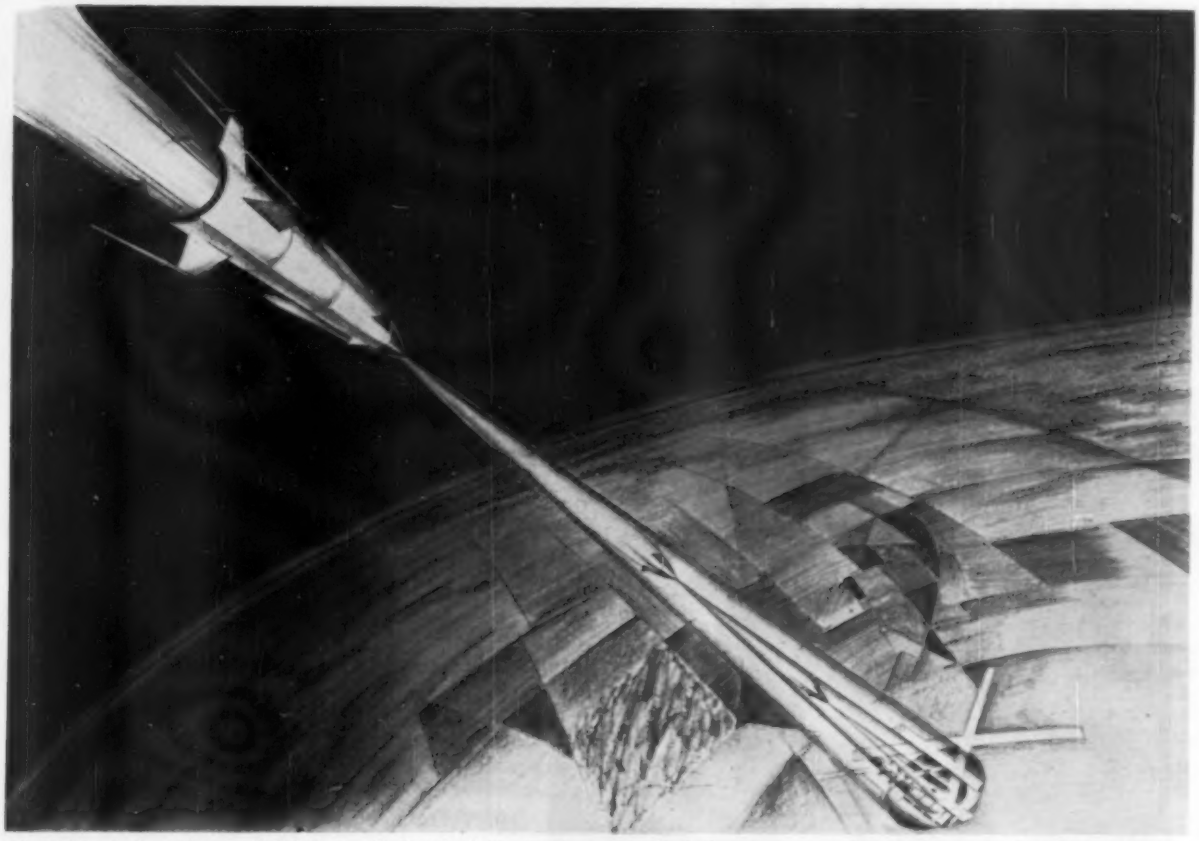

OPTICAL missile guidance called Selective Optical Lock-On (Solo) can visually lock onto any specific ground or water based target or target area. System, which appears difficult to jam, is useful for air-to-surface or surface-to-surface missiles.

Optical Guidance Designed for Missiles

By Philip J. Klass

Washington—A missile guidance system which can optically lock onto ground- or water-based targets whether or not they stand out visibly from the background, and which appears to be virtually unjammable, was disclosed here to Defense Department scientists.

The novel guidance system need only be aimed at any specific target or target area which has sufficient contrast to be discernible to the human eye and it will lock onto the target like a bird-dog, according to Chicago Aerial Industries which developed the system with its own funds.

Infrared Potentiality

The system is called Selective Optical Lock-On, or Solo for short. It appears to be usable with infrared radiation as well as with visible light.

The company expects to test an infrared version soon.

Complete missile guidance package, including optics, gyro stabilization and transistorized circuitry, is expected to weigh less than 10 lb., making it suitable for small tactical air-to-surface missiles, such as Navy's Bullpup and USAF's new White Lance. Technique also appears suitable for short-range surface-to-surface missiles.

Laboratory and flight tests indicate that Solo should have guidance error of no more than 2½ to 5 angular mils. This means that a Solo-guided missile that is launched two miles from target should have a guidance error of no more than 26 to 52 ft. Error increases, or decreases, linearly with release-point distance from target.

From an operational viewpoint, Solo is extremely simple to use and does not require that launching airplane be equipped with radar. The aircraft is aimed at the target so that Solo's optical field of view (about 0.6 deg.) is centered on target, then the lock-on signal is sent to Solo, after which it maintains the target centered in its field of view. Optics are gyro-stabilized about all three axes, using either air-driven or electric-powered gyro wheels which are brought up to speed prior to launch and then coast without power during flight.

Aiming Method

Solo could be aimed at the target by means of the airplane's gunsight, except that deflections of airplane wings may introduce errors in Solo's aiming point. Chicago Aerial Industries therefore has designed Solo to accommodate a built-in videcon (television camera) tube, if desired, which will transmit to the pilot and display on a cockpit cathode ray tube the exact field of view of the missile's guidance system. With this provision, the pilot need only maneuver the airplane until the cockpit display shows the missile is looking at the desired target, then initiate lock-on and launch.

New guidance system is outgrowth of Chicago Aerial Industries' work in developing an optical means for compensating for airplane ground-speed and altitude in the aerial reconnaissance

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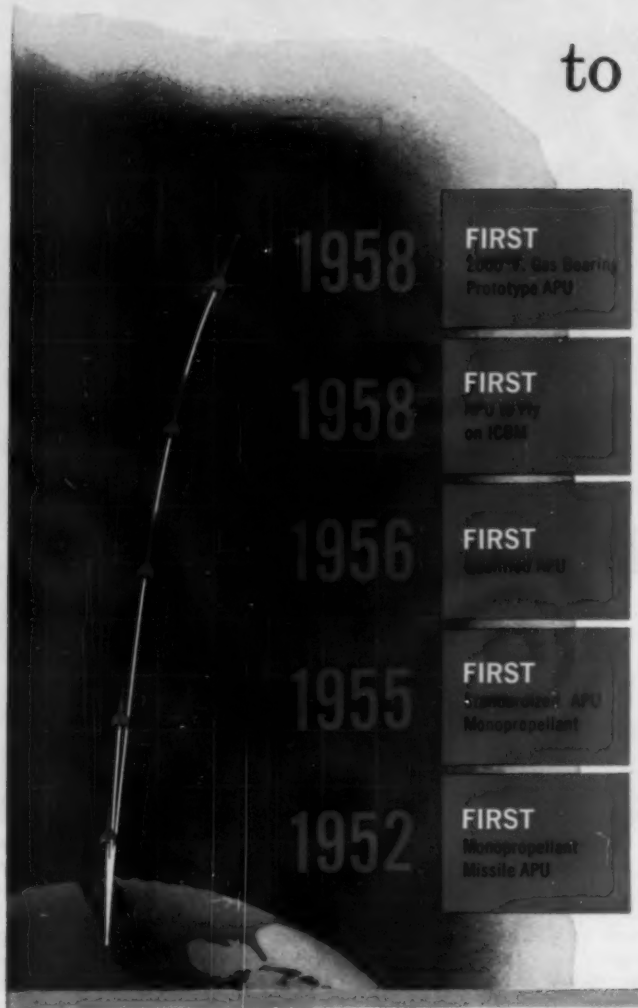

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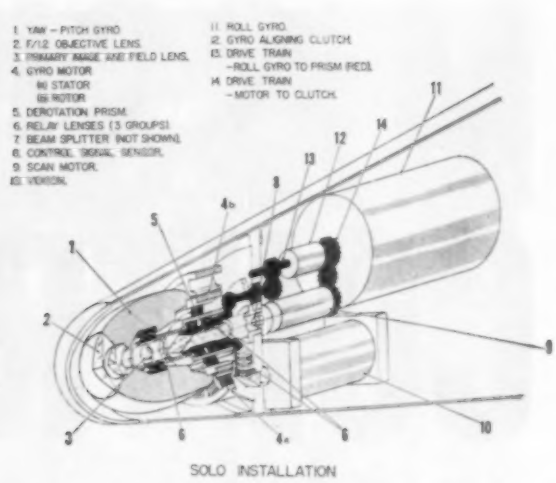
1. YAW – PITCH GYRO
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8. CONTROL SIGNAL SENSOR
9. SCAN MOTOR
10. VIDICON
11. ROLL GYRO
12. GYRO ALIGNING CLUTCH
13. DRIVE TRAIN – ROLL GYRO TO PRISM (RED)
14. DRIVE TRAIN – MOTOR TO CLUTCH

SOLO INSTALLATION

SOLO optical guidance system is simple, small and lightweight. Missile-borne guidance package shown in mockup at left, is expected to weigh less than 10 lb. Optics are gyro stabilized about all three axes. System installation is shown at right.

camera that it builds. These cameras have no shutter, moving the strip of film at the same speed as the ground appears to move under the airplane in order to eliminate ground motion. Film strip moves at a rate which is proportional to airplane ground speed and inversely proportional to its altitude.

Film Speed Control

By optically sensing the rate at which light and dark patches of ground move past a photoelectric cell, it is possible to obtain a signal proportional to desired ratio of ground speed to altitude, which is used to control film strip speed.

When the system is aimed at any target area, it "sees" a random collection of dark and light areas of random shapes and sizes. Solo generates control signals for the missile's autopilot so as to maintain this collection of dark and light areas in the same precise position relative to center of field of view as at instant of lock-on.

As the missile nears the target, the characteristic pattern of dark and light areas changes slightly because a smaller target area now fills Solo's field of view. This may cause the system aiming point to shift slightly to a new lock-on point, but this will always remain inside the area covered by the field of view at time the missile was launched, according to Samuel Bousky, chief scientist of Chicago Aerial Industries.

Tracking Capability

System demonstrated its ability to lock onto and track a variety of nondescript targets in movies of prototype system which were shown to AVIATION WEEK.

With the system mounted in a station wagon, it locked onto and tracked one brick among many in a brick wall, one tree among many, a pile of snow and similarly tracked a pile of dirt.

With the prototype flying in a lightplane, the movies demonstrated Solo's ability to lock onto clump of trees, an airport runway several miles away, and even to one cloud among many. Bousky says Solo can lock onto and track water surface because of different contrast provided by ripples.

Solo can lock onto a moving target, providing it dominates the field of view and provides sufficient contrast with respect to background, Bousky says. Movies showed the system tracking the left wheel of a moving truck as it traveled several hundred yards ahead of a station wagon carrying guidance system.

Any natural or man-made terrain which is sufficiently illuminated to produce a television image can yield sufficient contrast for accurate Solo guidance, Bousky says. If the technique also proves suitable with infrared, Solo should be able to operate day or night.

Hard to Jam

An important additional advantage of Solo is its comparative invulnerability to enemy countermeasures, according to Bousky. To fool Solo and lure it away from target area, the enemy would have to place a number of suitable lights on the ground, be sure they were within missile's field of view, then slowly shift them away from the target to get the missile to follow, according to Bousky.

New guidance system can operate at altitudes up to 40,000 ft., and at ranges up to 10 mi. from target, company officials say.

Solo's avionic circuitry is completely transistorized, requires less than 20 watts of electric power from missile during flight.

Chicago Aerial Industries, 1980 Hawthorne Ave., Melrose Park, Ill.

Expansions, Changes In Avionics Industry

Sylvania Electric and General Telephone Corp. will merge to become General Telephone & Electronics Corp., if stockholders approve, with combined assets of approximately $1.4 billion. General Telephone is nation's second largest telephone holding company, while Sylvania is a major supplier of defense electronics as well as consumer products.

Other recently announced changes, expansions in the avionics field include:

• **Materials for Electronics, Inc.** is name of new company set up to supply special purpose chemicals, metals, ceramics, minerals and components from Belgium, Brazil, France, Germany, Great Britain and Italy to electronic manufacturers. Headquarters is at Continental Hotel, Jamaica 34, N. Y., adjacent to N. Y. International Airport.

• **Douglas Microwave Co., Inc.**, Mt. Vernon, N. Y., has formed new division called **Spectra Electronics Corp.**, with offices at 250 East Third St., Mt. Vernon, to develop and manufacture in field of space electronics, guidance, data processing and acquisition systems, including infrared, radar and telemetry. Descriptive brochure is available by writing company, attention Dept. P-1.

• **Bradley Semiconductor Corp.** is new name of Bradley Laboratories, New Haven, Conn., to better reflect company's activities.

• **Telecomputing Corp.**, Los Angeles, has acquired controlling interest in **Frank R. Cook Co.**, Denver, through interchange of stock. New acquisition,

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which will be operated as a division, manufactures batteries.

• **National Cash Register Co.** is entering field of military computer systems with several major research projects under way at its Los Angeles and Dayton facilities.

• **Amphenol Electronics Corp.**, Chicago, will merge with the **George W. Borg Corp.**, Delavan, Wisc., with Amphenol President Arthur J. Schmitt becoming chief executive officer of new company. Mr. Borg is chairman of executive committee. New name is **Amphenol-Borg Electronics Corp.**

• **Waldale Research Co., Inc.**, Pasadena, Calif., has been acquired by **Consolidated Metal Products Corp.**, Albany, N. Y. New acquisition produces strain gages and transducers.

• **Raytheon Manufacturing Co.** has started construction of new 122,000 sq. ft. missile systems development laboratory in Bedford, Mass. Occupancy is scheduled for March.

• **Electronic Associates, Inc.**, has opened new 61,000 sq. ft. manufacturing facility at West Long Branch, N. J.

• **BJ Electronics Division** of Borg-Warner Corp., Santa Ana. Calif., has acquired Northam Electronics, Inc., Altadena, Calif., subsidiary of Norris Thermador Corp., which specializes in special weather and meteorological instrumentation. New acquisition will be combined with BJ Electronics operations at Santa Ana. Eugene Bollay, former president of Northam, becomes new director of research, meteorology instrumentation.

• **Mech-Tronics Corp.**, Melrose Park, Ill., has purchased 55 acres in Deer Valley, north of Phoenix, Ariz., and plans to build 30,000 sq. ft. plant which will employ 100, to supplement present Melrose Park facility.

FILTER CENTER

► **Maser-ized Intercept Radar**—Navy Bureau of Aeronautics will soon award a contract for airborne interceptor radar employing new Maser or parametric amplifiers, expected to extend range by a factor of at least six over current radars. Intercept radar being developed by Hughes Aircraft for USAF/North American F-108 supersonic interceptor also will use Maser or parametric amplifier (AW Nov. 10, p. 23).

► **Molecular Circuitry Predictions**—Size reductions by a factor of 100 to 500 in avionic components appear feasible

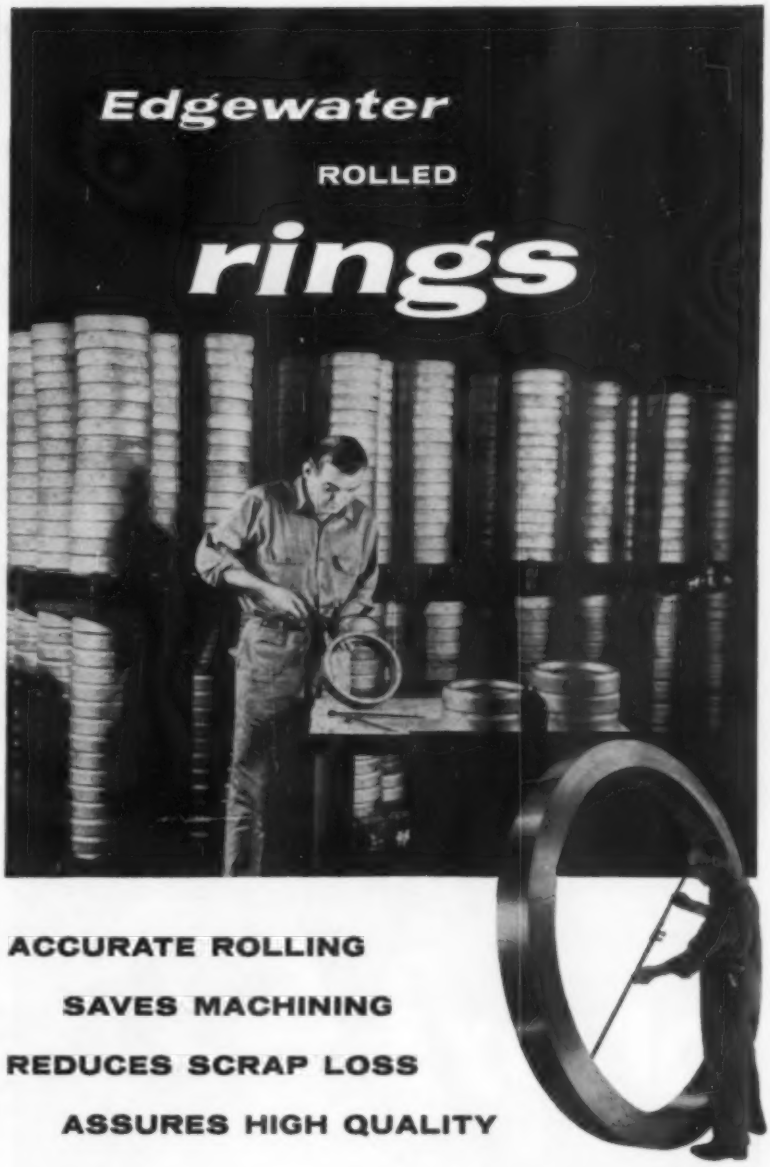
within 10 years, according to Dr. H. W. Welch, director of research and development for Motorola's Military Electronics Division. New approaches to solid-state circuitry will require extremely precise control of material composition, of thin films and manipulation of microscopic parts in assembly, according to Welch. He reported that this will be a fundamental objective of Motorola's newly-formed Solid State Electronics Dept.

▶ **Predicted Transistor Sales**—Transistor sales, expected to reach 44 million units this year, should increase 50% in 1959 to 66 million units, according to James H. Sweeney, marketing manager for General Electric's Semiconductor Products Dept. Sweeney said that annual dollar sales of new controlled rectifiers, whose function is similar to thyratron tubes, could match present transistor sales within five years.

▶ **Traveling-Wave Tube Forecast**—Sales of traveling-wave tubes, versatile, low-noise amplifiers that are finding increasing applications in radar and electronic countermeasures equipment, are expected to reach $7 million in 1959, according to Hans Jenny, manager of microwave engineering for Radio Corporation of America's Electron Tube Division. Jenny says that traveling-wave tubes have become reliable devices, considerably smaller, lighter and more rugged than early models.

▶ **New Infrared Detectors**—Three new types of infrared detectors with short time constants and sensitivities out to moderately long wavelengths have been disclosed by Philco Corp. Two of the detectors are N and P type gold-doped germanium photoconductors, with cut-off wavelengths of six and nine microns, respectively, and time constants of 30 and 0.1 microseconds respectively. Detectors have impedance of approximately one megohm. Third detector, made of indium antimonide, has low impedance, cutoff of approximately six microns and time constant of less than two microseconds, Philco says. Detector performance is based on operation at liquid nitrogen temperatures. Company reports it has developed miniature cryostats for detector cooling.

▶ **Tubes vs. Transistors**—Sales of vacuum tubes will rise from 420 million per year to 450 million during next several years, then level off at that figure, according to a prediction by Donald G. Mitchell, board chairman and president of Sylvania Electric. Total receiving tube sales in September were 40.1 million, down approximately 10% from same month last year, while transistor sales were 5.1 million units for same month, a 64% increase over same



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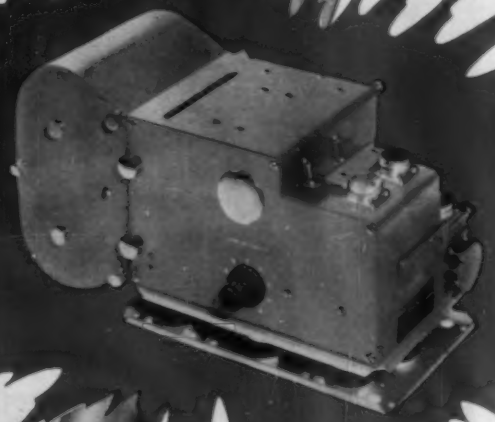

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month last year, according to figures released by Electronic Industries Assn. Total transistors sold this year in first nine months, 30.4 million, exceeded the 28.7 million sold in all of last years, EIA figures indicate.

▶ **Signed on Dotted Line**—Major contract awards recently announced by avionics manufacturers include:

• **Bendix Computer Division,** Los Angeles, has sold flight system simulators for ground testing of missiles to Army Ordnance Missile Command, Huntsville, Ala., and Convair Division of General Dynamics Corp. at Ft. Worth. Equipment includes flight simulation table with three degrees of freedom and an associated analog computer.

• **Motorola Military Electronics Division,** $715,000 contract from Boeing Airplane Co. for Bomarc guidance beacons.

• **Burroughs Corp.,** $22.8 million Air Force contract for 32 additional AN/FST-2 data processing systems for use in SAGE air defense program, bringing the total of such systems ordered to date to 98.

• **Sylvania Electric,** Waltham, Mass., reports contract from Rome Air Development Center for development of magnetic wideband recorder-reproducer using novel techniques, including a recirculating storage loop.

• **Telecomputing Corp.,** Los Angeles, a $115,000 award from Boeing Airplane Co. for floated rate gyros to be used in Bomarc missile.

• **Allen B. DuMont Laboratories,** Clifton, N. J., reports $450,000 contract from Chrysler Corp. for 31 missile test sets for Jupiter ballistic missile.

• **United ElectroDynamics,** Pasadena, Calif., $1 million contract from USAF's Ballistic Missile Center for transistorized telemetry systems to be used in ballistic missiles.

• **Tamar Electronics, Inc.,** Los Angeles, $160,000 contract from Boeing Airplane Co.'s Wichita Division for antenna systems for B-52G.

• **Minnesota Mining & Manufacturing Co., Mincom Division,** Los Angeles, two contracts totaling over $400,000 from Rome Air Development Center and Sandia Corp. for video-band instrumentation tape recording systems.

• **ACF Industries Nuclear Products-Erco Division,** two contracts from Naval Training Device Center for aircraft simulators to be used by Japanese Air Self Defense Force. One contract covers Lockheed P2V-7 simulator, the other three instrument trainers.

• **Consolidated Electrodynamics Corp., DataTape Division,** Pasadena, Calif., $217,000 contract from Air Research & Development Command for magnetic tape recorder/reproducer equipment for USAF Missile Test Center.

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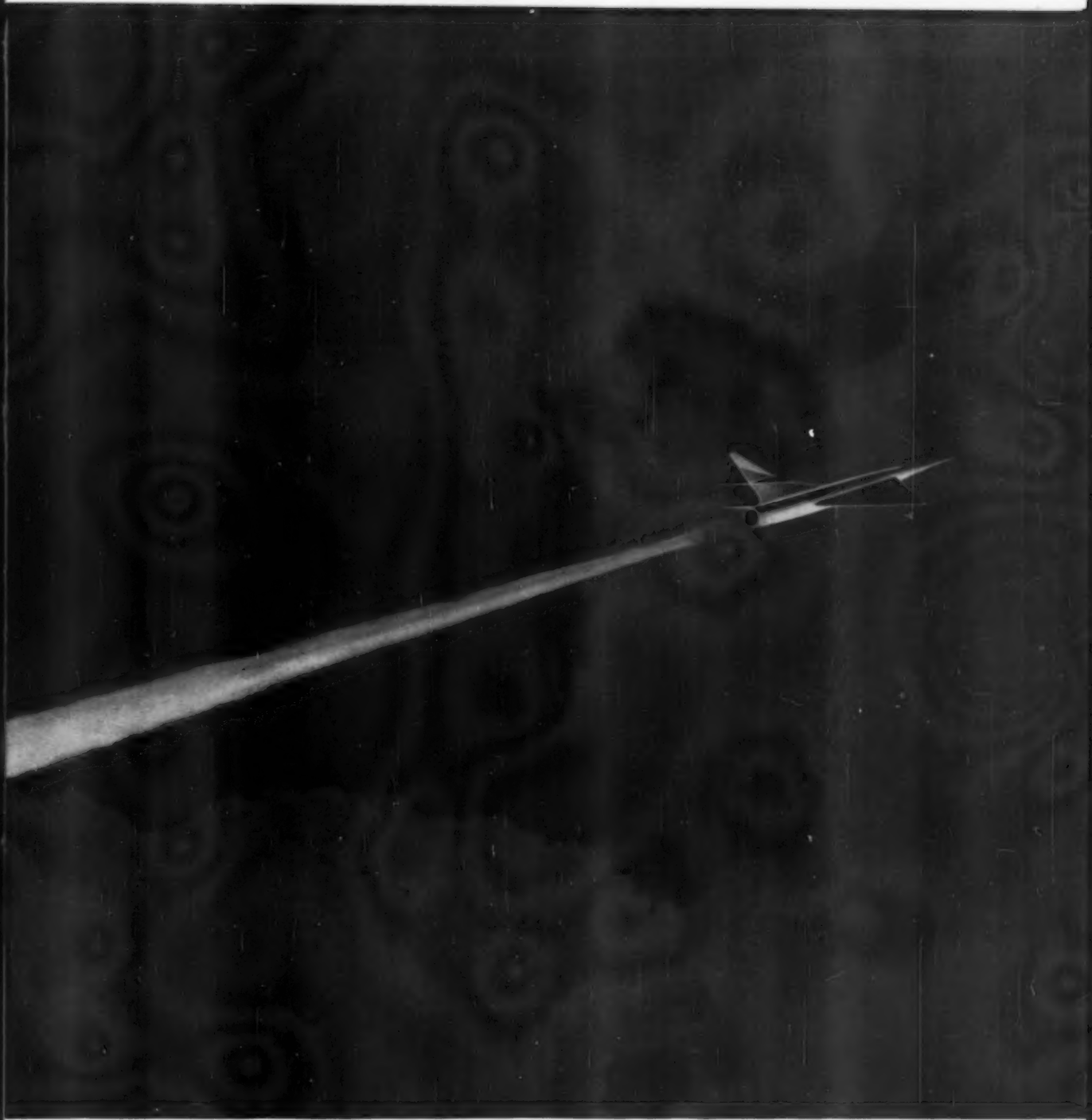
Fabricated molybdenum and Nicrotung, two of the latest Westinghouse metal miracle developments, are outstanding examples of metallurgical progress toward higher operating temperatures and more efficient airborne propulsion systems.

Inconel-clad molybdenum can be used in air-breathing engines without deterioration from high-temperature oxidation. "Clad-moly" parts have proved successful in extensive engine testing at temperatures above 2000°F.

Nicrotung is a new turbine blade alloy invented by Westinghouse through the use of "predesign"



techniques. A nickel-chromium-tungsten alloy, Nicrotung has the best high-temperature strength of known super-alloys and may be cast readily into intricate shapes.

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YOU CAN BE SURE...IF IT'S

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BELL'S turbine-powered HU-1 Iroquois is powered by 480-lb. Lycoming T53-L-1. Empty weight is 3,834 lb. Gross weight is 5,800 lb.

Aviation Week Pilot Report:

Minimum Effort Required to Pilot Bell's

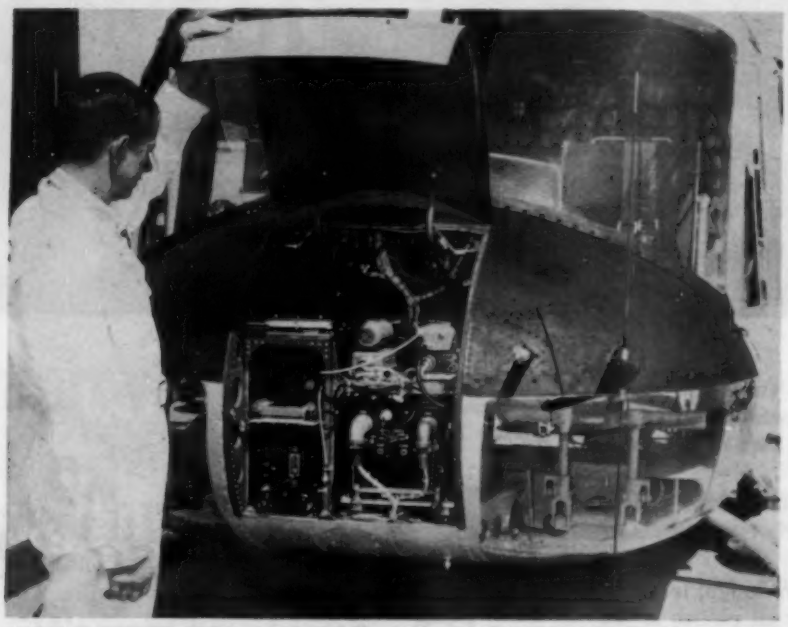
By Robert I. Stanfield

Fort Worth, Tex.—Designed from scratch as a turbine-powered utility helicopter for the U.S. Army, with components capable of minimum 1,000 hr. of operation between overhauls, Bell Helicopter's all-new HU-1 Iroquois is a highly stable rotorcraft that requires a minimum of pilot effort. Flight characteristics come close to those of fixed-wing aircraft.

Single-rotor HU-1—the service test and commercial versions of which are designated the YH-40 and Model 204, respectively—is powered by a lightweight gas turbine engine, the 480-lb. Lycoming T53-L-1. Fuel grade specified is JP-4.

Free turbine powerplant consists of an axial-centrifugal compressor (five axial stages and one centrifugal stage), an external annular vaporizing combustor, a gas producer turbine and a free power turbine which eliminates the need for a clutch (AW Sept. 30, 1957, p. 61). At sea level, the engine, which also was initially designed for helicopter use, is military-rated at 860 shp.

Design criteria of the HU-1 dictated that the helicopter would hover at 6,000 ft. out of ground effect when temperature is 95F. Derating at sea level, on the basis of torque, was mandatory for this power. Powerplant is derated to a maximum output torque equivalent to 700 hp. at 5,800 rpm. (770 hp. at 6,400 rpm.) for maximum continuous power at sea level.



QUICK access to Iroquois' avionic equipment is provided by a two-latch, hinged door. Rear of instrument panel is also accessible through this area.

Empty Weight

The light, 3,834 lb. (empty weight) HU-1 also exceeds in all respects initial Army requirements calling for a helicopter that would cruise at 100 kt., climb at 1,500 fpm. and deliver an 800-lb. payload over a 100-nautical-mile radius.

Helicopter flown by AVIATION WEEK for this evaluation was Army No. 55-4460, the second of Bell's three prototype XH-40s. Prototypes, with YT53 engines, are military rated at 825 shp. at sea level. They are one foot shorter than production models, which were lengthened for extra litter and passenger space.

Key performance features evidenced during flight evaluation included:

- **Fast start.** No warm-up is required of the turbine engine. Helicopter was airborne immediately following engine start. In tests, the HU-1 was in the air in less than half a minute after the pilot entered the cockpit; in about one minute the pilot was a mile away.
- **Noise level.** Minimum of noise and vibration was felt during all phases of flight. This can be attributed to the top-

HU-1 drive system components are located exterior of fuselage structure. Tail boom may be lowered by one man for rotor work.

HU-1 Iroquois

of-fuselage, aft-of-cabin engine mounting: a three-point rigid mounting system with a barrel spline connection between the output and transmission.

• **Acceleration rate.** From hover—about 5 ft. above the ground—the XH-40 was accelerated to 100 kt. in 12 sec., pointing up its capabilities for crash-rescue work.

• **Rate of climb.** From 100 ft. altitude, airspeed indicating 60 kt., the collective was pulled up and helicopter climbed out at rate of 2,000 fpm. Vertical climb, from hover, was made at 1,800 fpm.

• **Directional control.** Pulling 6,400 rpm. and with torque pressure indicating 18 psi., XH-40 was flown rearward at better than 50 kt., sideward at 40 kt. There would be no lack of control when operating crosswind. Yaw instability is offset by tail boom extension acting as a vertical stabilizer. Controllable elevator is mounted on tail boom.

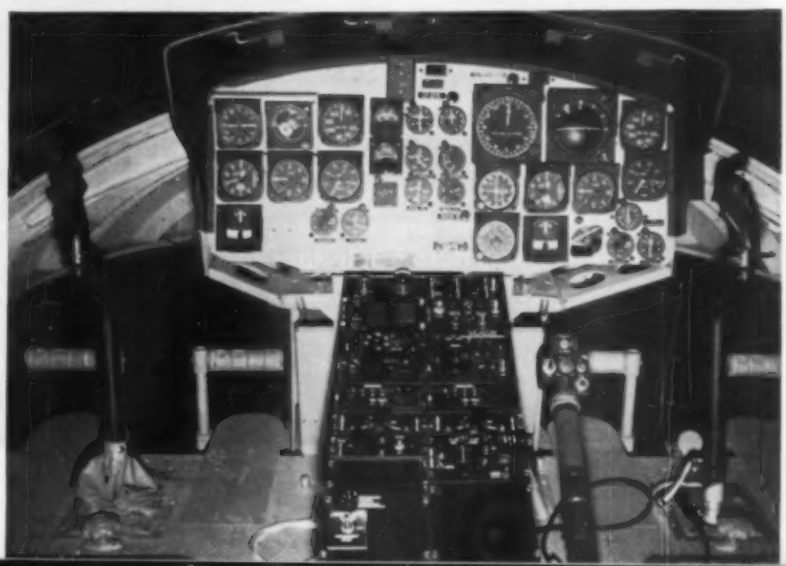
• **Hands-off flight.** During flight cyclic stick was held between knees, emphasizing helicopter's fixed-stick stability, a definite advantage for instrument flight rule flying. Helicopter is easily controlled. Response to control pressures is smooth but not overly sensitive. Indexing of rotor system relative to control system aids lateral control.

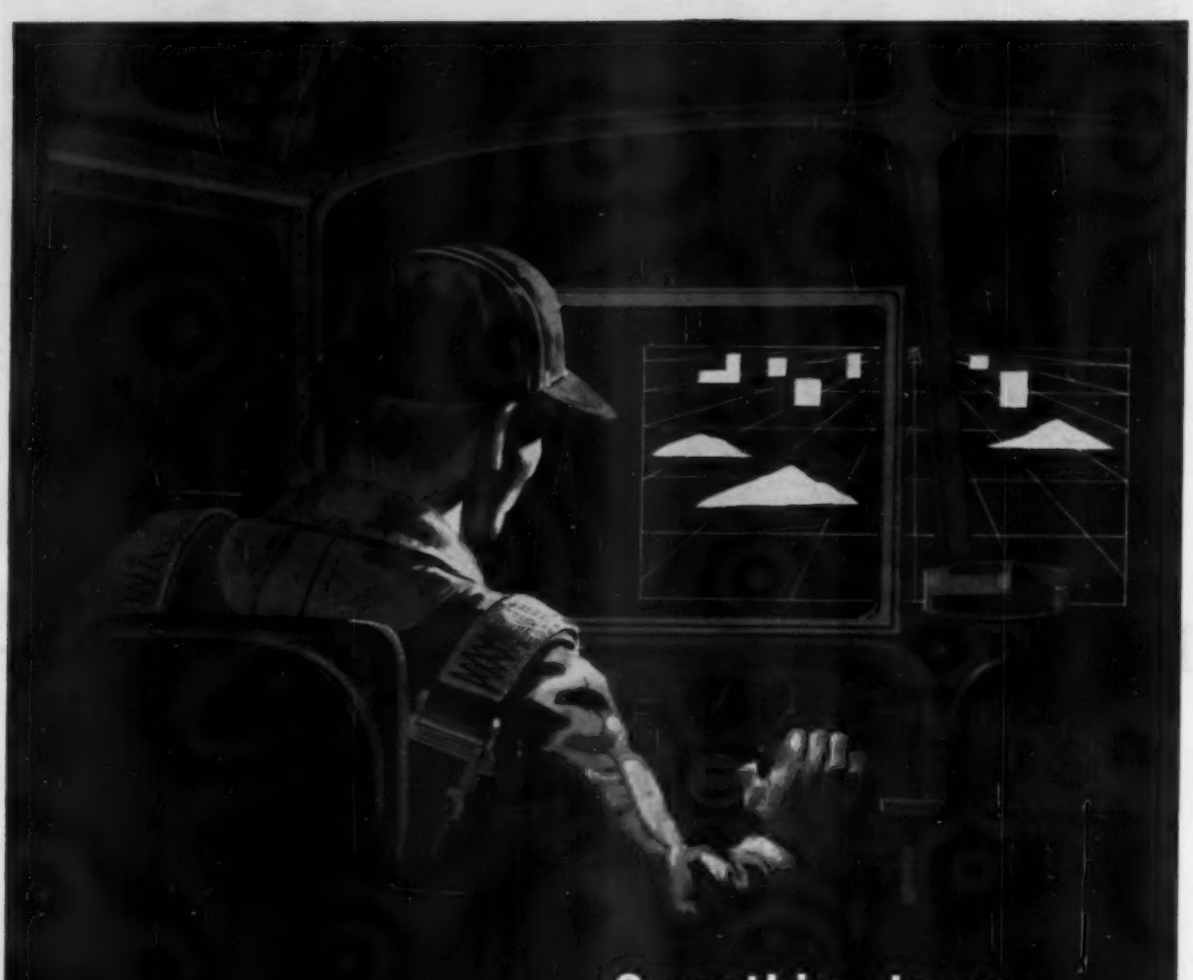
Gross Weight

With four of us aboard during evaluation, XH-40 grossed 5,200 lb. Maximum allowable gross weight of this model for flight testing only is 5,725 lb. Along with AVIATION WEEK pilot at the controls was Bill Quinlan, Bell engineering test pilot.

Helicopter on its skids sits close to the ground, making for easy access to

ALL components at right (above) are accessible via a built-in work platform only 54 in. from ground. Hinged cowling provides access to area. All major equipment is accessible from the outside. Cockpit (below) features dual instrumentation and dual controls. Future procurement on instrument configuration is still in question. Current HU-1A model has only a single set of instruments.



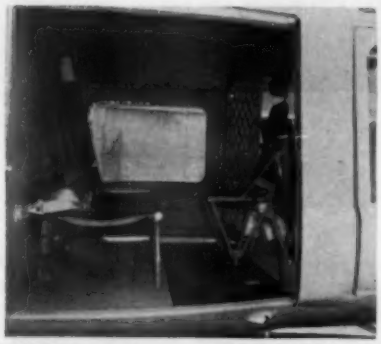


Something to see...

for the pilot who's flying blind

Autonetics' new Pilot Display Projector is another milestone in the elimination of blind-flying problems. It projects onto a special transparent screen, in the pilot's normal forward view, a bright replica of any instrument display, or combination of displays, that can be put on a cathode ray tube. The pilot is not distracted, as with other systems, by having to look down repeatedly at an indicator. And – since the display is transparent – his normal view through the windshield is unobstructed. Autonetics' Pilot Display Projector was originally developed for the Army-Navy Helicopter Instrumentation Program, but is adaptable to fixed-wing aircraft.

A DIVISION OF NORTH AMERICAN AVIATION, INC. · Downey, California **Autonetics**



CARGO compartment of HU-1 is 142 cu. ft. Cabin area contains a passenger seat, for four people, that can be folded and stowed.

the cabin. Skid gear consists of two lateral mounted arched cross tubes attached to two formed longitudinal skid tubes. Structural members are made from formed aluminum alloy tubing. Assembly is clamp-attached to fuselage at four points. Ground handling wheels are provided in loose equipment. They can be installed for ground movement. Skid is attached to tail boom.

Forward section construction consists primarily of two longitudinal beams with transverse bulkheads and metal covering. Beams provide support for cabin sections, landing gear, fuel tanks, transmission, engine, tail boom and are the attaching points for the 3,000-lb. capacity external cargo sling which is controlled by the pilot.

Tail boom is a semi-monocoque structure with metal covering and is bolt-attached to the forward section to allow easy removal or replacement. Rear of the tail boom supports the tail rotor, vertical fin and synchronized elevator.

Adjacent to each pilot's seat is a hinged door. Directly behind, on each side of the 142-cu. ft. cargo compartment, is a sliding door. Passenger-cargo cabin area contains a passenger seat, for four people, that can be folded and stowed against cabin aft bulkhead.

A litter rack and medical attendant

HU-1 Component Replacement Time

	No. Men:	Time:
Landing gear, skid type	2	30 min.
Engine, complete	2	30 min.
Starter	1	35 min.
Oil cooler	1	30 min.
Battery	1	5 min.
Generator, main	1	10 min.
Main rotor and hub	2	20 min.
Tail rotor hub and blade	1	30 min.
Transmission	2	40 min.
Tail rotor gear box, each	1	20 min.

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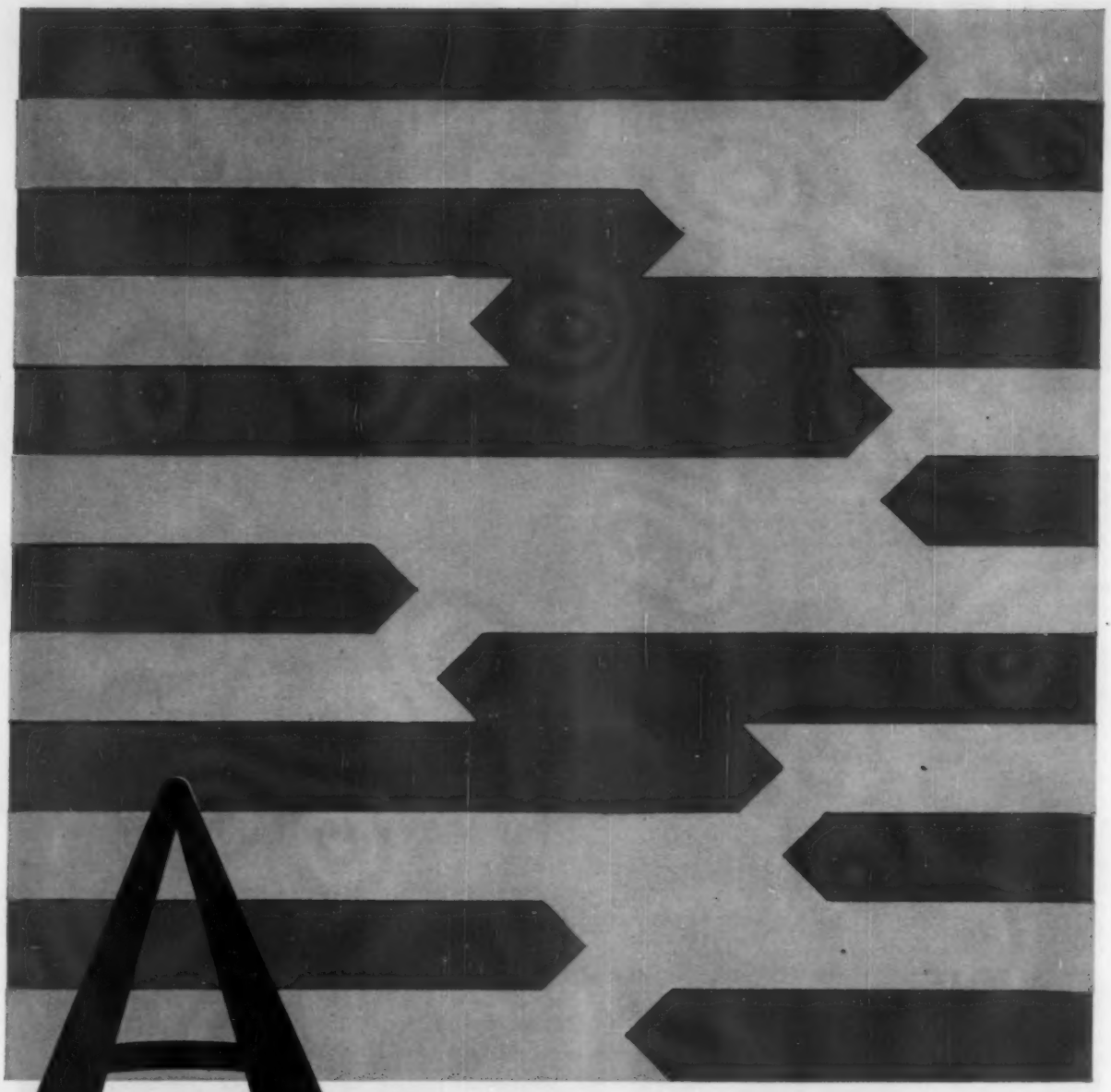

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Inquiries are welcomed on any phase of the solid propellant field—from preliminary design to quantity production.

ASTRODYNE, INC.
McGREGOR, TEXAS

seat can be quickly installed and two litter patients will be carried within the cabin of the military HU-1. Bell plans to change the center of gravity of the helicopter allowing more load in the cabin. Commercial version, the Model 204, will seat eight forward-facing passengers in two rows of five and three side-by-side seats.

Seating in the XH-40 flown was comfortable. Seats are adjustable, fore, aft and vertically. Visibility is good, with transparent plastic panels located at top, front, bottom and sides of cabin. Instrumentation and switches are positioned to the convenience of both pilot and copilot.

Overhead console mounts d.c. circuit breaker panels, plus switches for dome, navigation and instrument lights, cargo release, cabin heater, a.c. and d.c. power controls.

Center pedestal seats master control panel and panels for heater air control, engine control, hydraulic control, marker beacon, and VHF navigation, UHF transceiver, ADF receiver, emergency intercommunication.

Pilots' flight instruments are located on both left and right sides of main instrument panel. Current HU-1A model has only a single set of instruments. Engine instruments are centered.

Dual controls, which are quickly removable, are provided with all models. Control system is a positive mechanical type including cyclic control stick, collective pitch, adjustable tail rotor pedals, and the synchronized elevator which will be going to push-pull control.

The pilot's cyclic stick grip contains the cargo release switch, trigger-type three-position radio transmission switch and the force trim release switch. Copilot's stick grip does not contain the cargo release switch.

Collective pitch control lever on the pilot's side contains friction adjuster, a rotating grip-type throttle and switch box assembly containing starter, governor, landing light and searchlight switches. Copilot's collective pitch lever, when installed, contains only rotating-type throttle, governor switch.

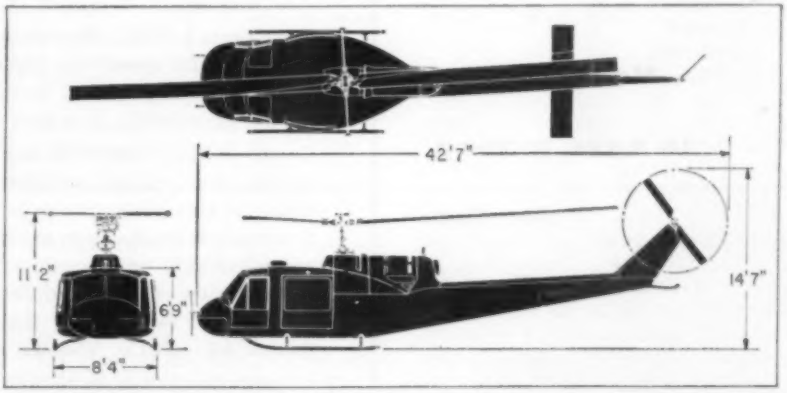
Starting procedures for the turbine engine are simple and quick; no warm-up period is necessary. With boost pump on and throttle cracked, starter-ignition switch is pulled and held. Starter energizing time is limited to 40 sec. Switch is released at 30-33% rpm. gas producer speed and throttle advanced to ground idle speed of 44% rpm.

Ground run and checks were made at flight idle (58 to 62% gas producer rpm.) and XH-40 was ready for takeoff. Outside air temperature was 29C. Sea level pressure was 29.92 in. Wind was from the east at 3 kt.

Helicopter smoothly flew up vertically

LENGTH of the HU-1 is 53 ft. Height is 14.6 ft. Width is 8.4 ft. Skid gear consists of two lateral-mounted arched cross tubes attached to formed longitudinal skid tubes.

IROQUOIS lifts a 1,600 lb. Hiller H-23 during Army user tests at Fort Rucker, Ala. External cargo sling, controlled by pilot, has capacity of 3,000 lb.



THREE-VIEW diagram of the YH-40. Production models have been lengthened slightly over a foot for extra litter and passenger space.

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at 1,200 fpm. to an altitude of 400 ft., then forward at 70 kt. indicated. With rpm. at 6,400 and gas producer rpm. of 86%, airspeed moved up to 105 kt. indicated. Exhaust temperature was 520C; torque was 22 psi.—about 500 hp.

First indications of blade stall were evidenced at 120 kt. IAS (indicated air speed), when amplitude of vibration increased above threshold of comfort. This was compensated by a reduction in collective pitch, thus a reduction in blade angle.

Airspeed is yellow-lined at 70 kt. Minimum of 6,200 rpm. above this speed is necessary to ward off blade stall. Indicator is red-lined at 105 kt. but extra engine power available makes it too easy to exceed this figure.

Capabilities for upping the top speed of production helicopters were evidenced in a recent USAF speed run where third beefed-up prototype XH-40 was reported to have flown in excess of 150 kt. IAS.

Turbine engine is also marked by fairly flat torque curve. Engine power is available at low rpm. During hover, rotor was backed off to 5,800 rpm. for added efficiency. Good stability characteristics stem from stabilizer bar which is mounted above and 90 deg. to the rotor; is partially restrained in its movement by hydraulic-type dampers.

Control Forces

Light control forces are reduced to near-zero pounds force, to lessen pilot fatigue, by hydraulic boost cylinders connected to control system mechanical linkages and powered by a transmission driven pump.

Force trims connected to the cyclic and directional controls are electrically operated mechanical units used to induce artificial control feeling into the cyclic-directional controls and to prevent the cyclic stick from moving of its own accord.

Before flying with boost power off, helicopter was first landed. Flying the XH-40 off the ground, no boost control, was no problem. It was uncomfortable. However, feed-back forces were only apparent when controls were in motion.

Again, from hovering position, vertical takeoff was made. Holding the XH-40 in hover, collective was pulled full up. Helicopter went straight up for 600 ft. at 1,800 fpm. Moving forward in cruise condition, airspeed indicated 100 kt. Torque pressure was 21 psi. Gas producer rpm. was 86%. Tail pipe temperature was 530C.

Two low-pressure torquemeter indicators are located on the pilot's and copilot's sides of instrument panel. They are connected to a single transmitter which is part of the engine oil system and indicate readings of torque imposed upon engine output shaft.

Bell HU-1 Iroquois Specifications

Empty weight	3,834 lb.
Gross weight (varying per mission type)	5,100 to 5,800 lb.
Useful load (varying per mission type)	1,266 to 1,966 lb.
Over-all length	53 ft.
Over-all width (landing gear skid tubes)	8.4 ft.
Over-all height (ground attitude)	14.6 ft.
Stabilizer bar diameter	9 ft., 0.5 in.
Main rotor:	
No. blades	2
Rotor diameter	44 ft.
Rotor disk area	1,520 sq. ft.
Rotor disk loading at 5,400 lb. gross wt.	3.55 lb./sq./ft.
Blade chord length	Root 15 in.; tip 15 in.
Blade twist	12 deg.
Blade feathering axis	24% chord
Blade area, each	27.5 sq. ft.
Rotor rpm.:	
at 5,800 engine rpm	284.5 rpm.
at 6,400 engine rpm	314.0 rpm.
Rotor tip speed:	
at 5,800 engine rpm	655.4 ft./sec.
at 6,400 engine rpm	723.3 ft./sec.
Tail rotor:	
No. blades	2
Rotor diameter	8 ft. 6 in.
Rotor disk area	56.8 sq. ft.
Blade chord length	root 8.41 in.; tip 8.41 in.
Blade twist	zero deg.
Blade area, each	2.98 sq. ft.
Rotor rpm.:	
at 5,800 engine rpm	1,453.5 rpm.
at 6,400 engine rpm	1,603.9 rpm.
Tip speed:	
at 5,800 engine rpm	646.9 ft./sec.
at 6,400 engine rpm	713.8 ft./sec.
Performance:*	
Cruising speed (less than 60% power)	115 mph.
Hovering ceiling (out of ground effect)	11,500 ft.
Hovering ceiling (in ground effect)	14,000-plus ft.
Vertical rate of climb, in excess of	1,400 fpm.
Best rate of climb, in excess of	2,000 fpm
Fuel capacity (normal)	125 gal.
Range, in excess of	210 st. mi.

(* approximates, pending completion of Phase IV testing at Edwards Air Force Base, Calif.)

Engine: Lycoming T53-L-1 (model LTC1B-1)
Weight: 480 lb.

Ratings:	shp. (min.):	Jet Thrust lb. (min.):	eshp. (min.):	Output shaft rpm.:	Equiv. Spec. Fuel Consumpt. lb./eshp./hr. (max.)
Military	860	102	866	6,790	.673
Normal	770	96	808	6,610	.689
90% normal	693	89	729	6,320	.706
75% normal	578	78	609	5,900	.748

During varying degrees of turn and bank, rpm. held stable. Only the collective was used for increase of power and altitude. Use of rudder takes about 7-10% of power put into main rotor.

Tail rotor of the HU-1 differs from that of other Bell helicopters in that it is pusher type rather than tractor type. Assembly is a two-bladed (metal), rigid, delta-hinged type incorporating preconing and underslinging.

Each blade is connected to a common yoke by means of a grip and suitable pitch change bearings. Blade and yoke assembly is mounted on the tail rotor shaft by means of a delta-hinge trunnion to minimize rotor flapping. Power is from a takeoff on the lower

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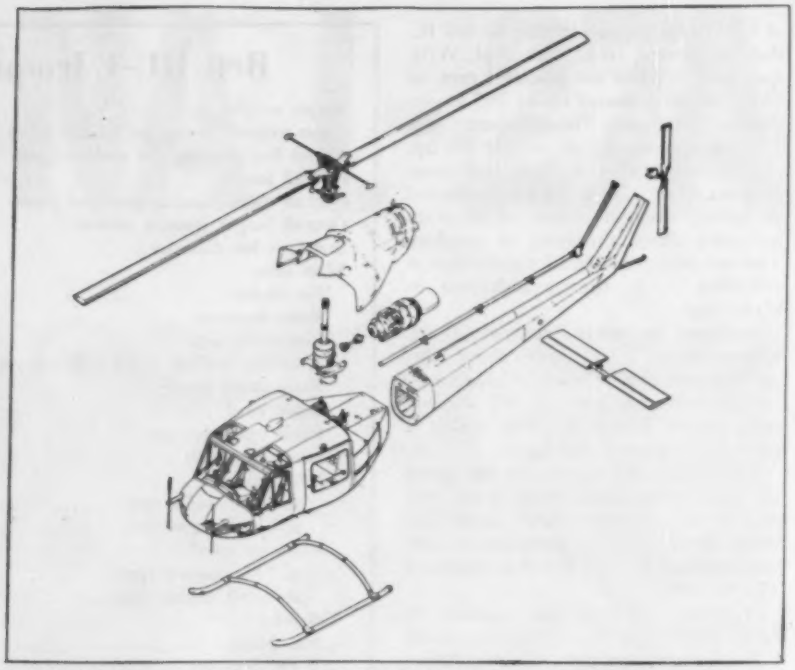

CUTAWAY diagram of the HU-1. Only 32 special tools are required for the helicopter. Anti-torque drive shaft incorporates five interchangeable sections.

end of the main rotor transmission.

Autorotation was made from 1,000 ft., with a 3 kt. crosswind. Mixture was reduced to idle cutoff. Engine rpm. was 5,800. Rotor rpm.–limits are 285 to 314–was 314. Gas producer rpm. was 60%.

No excessive manipulation was required. Rate of descent was 1,600 fpm. XH-40 ran forward on skids for about 30 ft. before coming to a halt.

Helicopter's main rotor assembly is a two-bladed, semi-rigid see-saw type also employing preconing and underslinging. Assembly consists of two all-metal bonded blades with corrosion- and scuff-resistant leading edges, blade grips, yoke, mast, stabilizer bar and rotating controls.

Blades are connected to a common yoke by blade grip and pitch change bearings, with tension straps to carry centrifugal forces.

Rotor assembly is attached to mast via cardan type universal joint and secured with a cap fitting which incorporates provisions for attaching a cable to hoist the helicopter.

While the rotor system incorporates conventional Bell blades, feathering is not similar to that of the H-13; rather, as would an articulate rotor–blades feather around pitch-change bearings.

Design competition for a utility helicopter was initiated by the Army in May, 1954, through the Air Force. The Bell configuration won the competition in June, 1955, when the company was awarded a design contract.

Initial flight was made in October, 1956. Phase II flight testing was completed in June, 1957, and first production model HU-1 was delivered to the Army in September of this year. Initial scheduling, as based on Phase II testing, was beaten by about a year.

The Iroquois is capable of operating from prepared or unprepared takeoff or landing areas under instrument conditions including light icing, day or night flying, and of navigating by dead reckoning or by use of radio aids to navigation.

It was designed for transportation of personnel, special teams or crews, medical evacuation, ambulance service, equipment and supplies and, with dual controls, instrument training.

First three prototypes–XH-40s–are involved in 1,000-hr. tiedown test programs and Phase III contractor flight tests at Bell's Fort Worth plant.

Test Models

Six service test models–YH-40s–have been built. The first also is undergoing Phase III flight test at Bell. The second is undergoing USAF Phase IV flight testing at Edwards AFB, Calif.; the third, joint USAF-Army Phase V testing. The fourth YH-40 is being put through the Phase E user evaluation tests by the Army Aviation Board at Fort Rucker, Ala.

Fifth and sixth service test models, also at Fort Rucker, are undergoing rigorous 1,000-hr. Phase F Army logistics evaluation conducted by TATSA (Transportation Aircraft Test and Support Activity).

Nine "pre-production" HU-1s are

being built at rate of one a month. The first—rolled out in September—has gone to the Army for testing in Alaska. The second is at the Bell plant for testing in the Army-Navy Instrument Program (ANIP). The third will be at Fort Rucker for Phase E testing by Army.

Bell is planning as large a production schedule for the HU-1A as for any helicopter it has produced.

Test programs have pointed up HU-1 capabilities (AW Sept. 22, p. 58). During climatic tests at Eglin AFB, Fla., engine, after cold soaking at −30F, was started and accelerated to maximum power in 43.5 sec. without any preheat on any components, and minus ground support equipment.

Engine also was run through severe 50-hr. desert test in Yuma, Ariz. Recalibration showed a loss of only 1% in fuel consumption at full rated power and 2% at 75% power. During desert trials, the engine ingested 65 lb. of sand continuously over a 25-hr. period, with loss of only 10% power.

At Fort Rucker, in accelerated 1,000-hr. test program, each helicopter is accumulating 10 to 13 hr. daily. Designed for 1,000 hr. on all components, engine has passed 150-hr. overhaul level.

Bell also is conducting 1,000-hr. ground tests and transmission bench testing. USAF is conducting 1,000-hr. test on rotor system at the Wright Air Development Center, Dayton, Ohio. Here, static test to a limit load factor of 4.5Gs has been completed.

Running through tests at Edwards AFB, YH-40, which had been test flown to 16,000 ft., was used to rescue an injured man from atop a 10,000-ft. peak, after first having had to surmount a 14,000-ft. peak en route.

HU-1 Maintenance

HU-1 features, such as oil level sight gages, rapid access doors and low silhouette, provide for rapid inspection of most components from ground level. The following items can be replaced or disassembled without removal of major component from the helicopter:

- **Engine components.** Reduction gearing, power turbine section (including burner, fuel nozzle, gas producer turbine and free turbine wheel), all accessories (including fuel system, governor and electrical components).
- **Main transmission.** Following drive gear quills plus their accessories (input drive, tach drive, boost pump drive, generator drive, tail rotor drive), main transmission oil pump, filter, relief valve, pressure warning switch, thermocouple and pressure transmitter, free wheel unit, rotor brake.
- **Hydraulic system.** All components can be removed without removal of other components.

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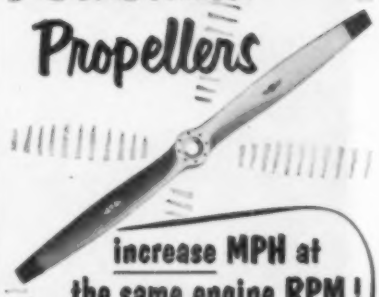

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Modern defense in action:*

PAINTING BY CHESLEY BONESTELL

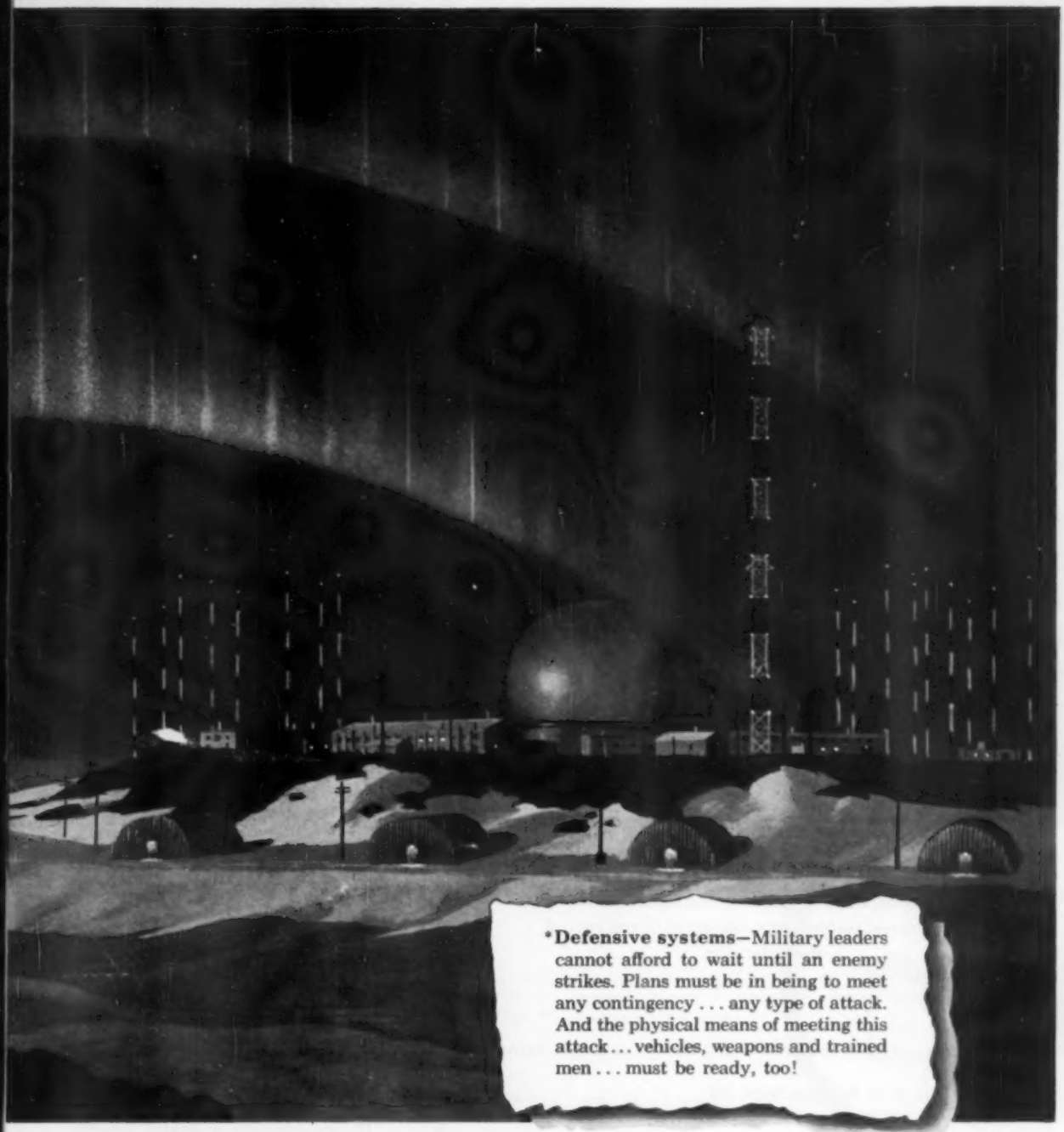
The threat...mass bomber attack across the

You are on radar duty at America's Dew Line—near the top of the world—and spot a mass of bombers approaching at supersonic speed. Another Pearl Harbor?

Not likely! Your warning signal alerts a defense system which is in being now. Fighter planes streak out in a matter of minutes, armed with rockets like the Air Force *Genie*—a Douglas built missile which can down an entire bomber formation with one blast.

In addition, our Army is ready for any aircraft that filter through with ground-based Nike Ajax and the still more potent, nuclear-armed Nike Hercules. Radar-guided, these missiles can take out fast aircraft despite all evasive action.

It is no accident that we are now ready for attack from across the North Pole. Such problems were anticipated by



*Defensive systems—Military leaders cannot afford to wait until an enemy strikes. Plans must be in being to meet any contingency . . . any type of attack. And the physical means of meeting this attack . . . vehicles, weapons and trained men . . . must be ready, too!

North Pole

Search radar antenna mounts 24 hour guard at edge of Arctic Circle . . . flashes immediate warning to defense centers

our Army, Navy and Air Force planners years ago. Industry became their partner in finding a solution. Western Electric and Douglas, for example, teamed up to develop Nike in 1945. Douglas has been working on missiles since before Pearl Harbor. This same forethought is in action right now, perfecting the systems of defense needed against tomorrow's aggressors.

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Background should qualify for planning and formulating entire flight test programs.

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Must be able to analyze missile configuration to determine aerodynamic performance and stability and control characteristics.

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Missile Division
North American Aviation, Inc.
12214 Lakewood Blvd., Downey, California

MISSILE DIVISION
NORTH AMERICAN AVIATION, INC.

the HU-1. Only five special tools are required for organizational maintenance.

All major equipment is accessible from the outside. All drive system components are located on the exterior of the fuselage structure. Hinged cowling allows rapid access. The tail boom may be pulled down by one man for accessibility from ground level. Anti-torque drive shaft incorporates five interchangeable sections.

Two-latch hinged door in nose gives access to avionic equipment, plus access to rear of instrument panel. Electrical components are also located in left aft portion of fuselage, with battery only 22 in. above ground level.

From the right side of the helicopter, hinged doors open to expose heater and blower unit. Large aft door also gives access to engine fuel filter, engine controls, engine oil cooler and tail rotor controls.

Both fuel filler neck and oil filler systems are on right-hand side of rotorcraft, away from and on opposite side of tail rotor.

The HU-1 can be disassembled quickly for transportability by cargo-transport. With only four bolts to pull tail booms, and with booms pulled and racked, four HU-1s can fit into a Douglas C-124. The aircraft can take two helicopters with tail booms.

Estimated load time—including 70 min. to prepare the HU-1 and 80 min. to stow it on an aircraft—is 2 hr. 30 min. Estimated unload time—including 80 min. to unload the helicopter from a C-124 and 80 min. to reassemble the HU-1—is 2 hr. 40 min.

Fuel, Power Control

Under normal flight conditions the power turbine speed governor controls free power turbine rotor speed. The gas producer speed governor safeguards the engine against overloading, and on acceleration and deceleration the control prevents engine damage or combustion blowout due to sudden changes in power selection.

Fuel control system provides a simple emergency control which can control the engine in event of malfunction in the primary system. The power control is a fully hydro-mechanical unit which derives its operation solely from a direct geared connection to the gas producer section of the engine.

The transmission is located directly forward of the engine and coupled to the power turbine end of the engine with a short drive shaft. It is basically a reduction gear box which transmits engine power at reduced rpm. to the main and tail rotors. Transmission incorporates a free-wheeling unit at the input drive and a two-stage planetary gear train.

Free-wheeling unit provides a disconnect from the engine in case of

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power failure and allows the main rotor and tail rotor to rotate for safe autorotation. Tail rotor is powered by takeoff on lower aft section of transmission.

Hydraulic power is supplied by a single hydraulic system consisting of variable output hydraulic pump, reservoir, accumulator, power cylinders, irreversible valves, relief, check and pressure reducer valves, solenoid valve and connecting hardware. The pump is mounted on the transmission and supplies boost power to the power cylinders which are connected into the mechanical linkage of the flight control systems.

Power for the 28 v.d.c. single conductor dual-bus electrical system is supplied by either the generator, the battery or an external power supply. The 28v. generator is rated at 300 amp. output. Two 250v. amp., three-phase inverters convert d.c. to 115 v.a.c.

Helicopter's heating and defrosting system consists of a combustion-type burner, electrically powered blower, plenum chamber, ducting and registers for transfer of heated air from the unit to the cabin areas.

Fuel for the combustion unit is supplied from the engine fuel system. Air is drawn in through an intake (inside or outside) and forced through heat exchange unit surrounding the combustion chamber. Heated air is blown into the plenum chamber and through ducts into cabin areas.

Small Business Group Uses Team Philosophy

Los Angeles—A plan to coordinate efforts of small businesses to permit participation in relatively large defense contracts is being formulated by the San Fernando Valley Small Plants Assn. Association's contracts committee now is compiling all data on individual skills of member companies to qualify them for participation in submitting a single bid on large contracts.

Under this arrangement, conception is to have a contract awarded to any one member of a team, with other team members participating according to their specialized skills.

Regular monthly meetings will be held to resolve problems of communications and coordination, as well as to keep members abreast of new developments. Contracts committee is headed by Les Jones, president of Les Jones Training Aids, Inc., who has established a business as a prime contractor with a contract for cockpit training procedures, portions of which are subcontracted to other association member companies.

One association is receiving guidance and assistance from the Van Nuys Chamber of Commerce, Small Business Assn. representatives, local bankers and industrial representatives.

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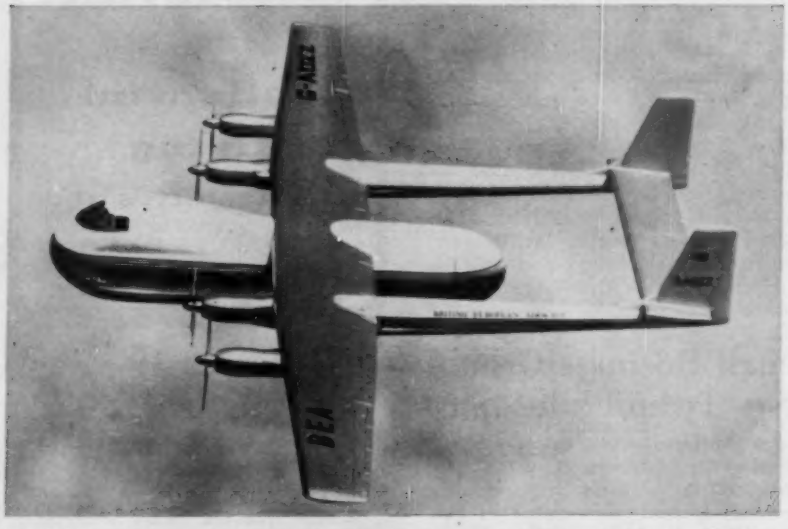
PROTOTYPE AW 650 center wing section is mated at Baginton plant. Aircraft's first flight is scheduled for this week.

AW 650 Freighter Nears First Flight



AW 650 emphasizes bulbous nose configuration in artist's conception (above). Below is drawing of AW 670 Airbus which has wider double-deck fuselage, can haul 126 passengers.

By John Tunstall

London—Armstrong Whitworth AW 650 Argosy, twin-boom, turboprop-powered freighter and coach transport is scheduled to make its first flight this month as the initial aircraft in a family based on the packet fuselage principle.

Two other prototypes, now under construction, are the AW 660, a pressurized military transport which can be fitted with alternative tail doors (AW Feb. 11, 1957, p. 41), and the AW 670 Airbus, a short-haul configuration which has a wider fuselage and can be used for passengers, freight or ferry missions.

Intensified production schedule calls for 10 aircraft to be completed late next year. Fourth Argosy will be used for sales and demonstration tours. Company officials said the aircraft's jig system was duplicated from the outset to meet a production target of two aircraft per month.

In a recent message to Armstrong Whitworth employes at the Baginton aircraft plant, E. D. Keen, chief designer, emphasized it was not the policy of the company to "parade half-baked aircraft in front of admiring Farnborough crowds."

Investment so far in the project by the parent Hawker Siddeley Group amounts to about $30 million. An effort will be made to get full British and U.S. certification by mid-1960. Tests to destruction on two completed aircraft will follow the flight test program. Production effort has been described as "unparalleled" in British aircraft industry.

Argosy is optimized for mixed freight transportation over stage lengths on the order of 300 to 1,500 mi. Fully factored (Air Transport Assn.) direct operating costs over this range spectrum are claimed to be down to nine cents per short ton mile.

The aircraft is powered by four Rolls-Royce Dart R.Da 7/2 turboprop engines, producing 2,100 eshp. Front and rear cargo doors are side-hinged and are opened by hand winding.

Fuselage section, swung from three different radii, which accommodates the freight floor at truck-bed level for easy cargo handling met one of the main requirements revealed by the group's extensive world-wide market survey. Straight-through loading with full-width freight doors at each end was another requirement and dictated the twin-boom, free fuselage configuration. And to cut loading and conversion times, specially designed quick-release keying frames and lashing clips were introduced together with triple seat units which fold outwards to lie against the fuselage sides.

Maximum payload of the Argosy with full reserves is 27,000 lb. over 300 mi. stages falling to 15,000 lb. over sectors of 1,700 mi. Cruising speeds are of the order of 300 mph. at heights between 20,000 and 25,000 ft. Gross freight cabin volume is 3,680 cu. ft. and accommodation provides for between 71 and 83 passengers seated six abreast. Length and width of the freight floor are 46 ft. 8 in. and 10 ft. respectively, and minimum height under the wing spars is 6 ft. 8 in.

According to the Hawker Siddeley survey, these characteristics "are just right" from 1963 onwards for the stage lengths and payloads on 90% of the world's airways. "There won't be too much load for the aircraft nor too much aircraft for the load," a company official reported.

Double Deck Fuselage

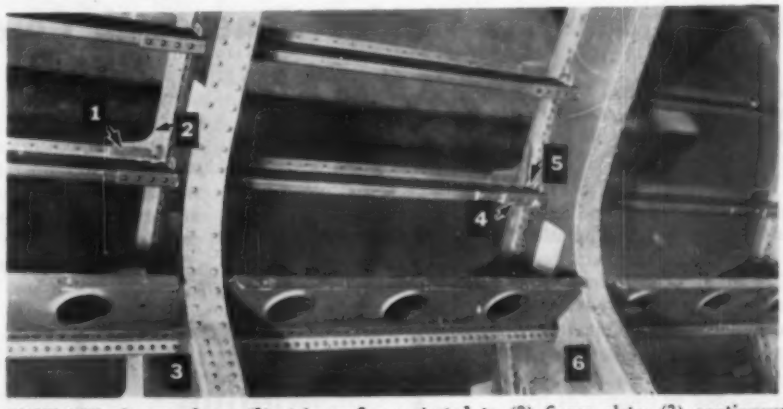
A much wider double deck fuselage slung by swinging links from the same high wing configuration will form the AW 670 short haul version. The fuselage, 180 in. wide, utilizes the maximum distance between the propeller arcs of the inboard engines. With accommodation for 126 passengers, the company claims it can operate fully factored on stage lengths as low as 200 mi. at a direct operating cost of 2 cents per seat mile, or 11 cents per capacity ton mile as a cargo freighter. This version is not pressurized because of the short haul characteristic, a feature which allows the fuselage to depart markedly from a circular cross-section.

As a car ferry it has room for six cars, two abreast, on the lower deck and 30 passengers on the upper deck. The AW 660 differs only in having a horizontal door at the rear with an integral loading ramp. Substantial orders for the AW 660 are expected from the Royal Air Force soon, according to reliable sources.

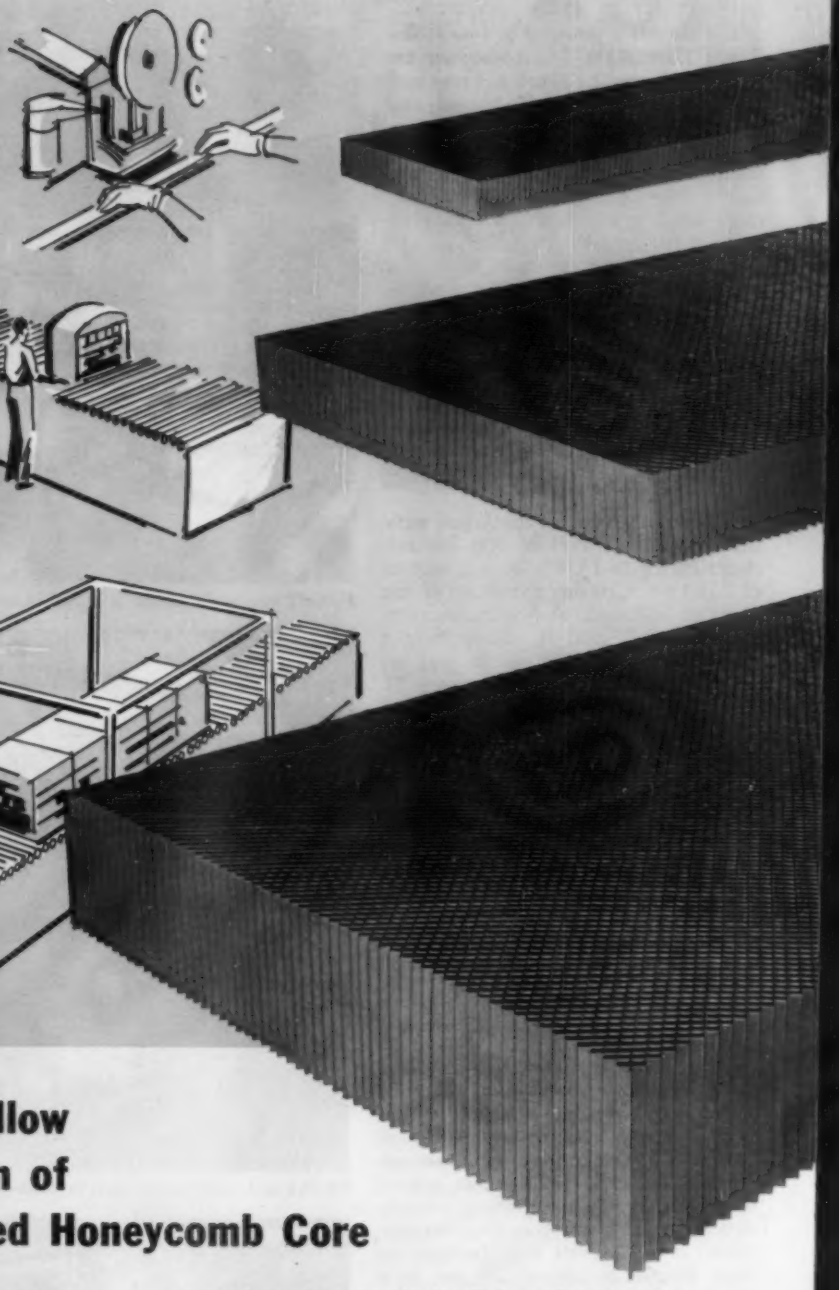
Adoption of the complete Rolls-Royce Dart R.Da 7/2 power package

FLIGHT engineer's station is shown in mockup version for U.S. certification tests.

TRIPLE seat units (above) can be folded against fuselage sides to expedite conversion.



FUSELAGE closeup shows (1) stringer flange riveted to (2) finger plate; (3) continuous frames; (4) stringer flange joined by strap through frame web and (5) cleated to frame and (6) reduxed webs at floor level, with graduated thickness.



NOW IN PRODUCTION: 6 machines—a total of approximately 140 sq. ft. per day. Blankets 1 1/16" deep, up to 48" wide, 20 ft. long. Total of 9 machines will soon expand production to about 200 sq. ft. per day.

COMING SOON: a new machine with expected production rate of 6 cu. ft. per day. Planned blanket size 8" deep, 5 ft. wide, 5 ft. long.

IN DEVELOPMENT: machine in final design stage, promises 120 cu. ft. per day in blankets 12" deep, 4 ft. wide, 10 ft. long.

New Equipment at Swedlow Will Increase Production of High Temperature Welded Honeycomb Core

Larger blankets, greater cell depths and substantially increased quantities of welded honeycomb core will give designers new opportunities as Swedlow expands production facilities.

Engineers can now look forward to important new uses for high temperature honeycomb. Greater cell depths, larger blanket widths and lengths will be available in the near future. Increasing quantities will be produced by big, fast semi-automatic machines. This pioneering venture will result in larger core structures with strength-to-weight ratios not now obtainable. It foretells the machining of core in larger compound shapes. It is the long-awaited beginning of true large scale production of highest quality welded honeycomb core.

Swedlow precision standards will be pushed even further: uniform welds, close tolerances, uniform cell sizes and shapes, optimum node widths, flatness and bond strength, and elimination of the problems of canted cell walls. High strength-weight and rigidity-weight ratios, vibration damping and fatigue resistance – all these properties will be available for an ever increasing variety of corrosive and structural applications.

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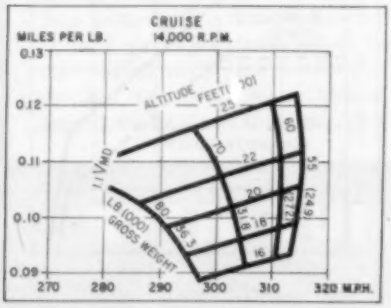
WING and landing gear detail shows (1) center intermediate wing joints (2) retracting jack and (3) spring-loaded locking piston. Note AW 650 dual wheel system.

used in the Vickers Viscount and supplied by Vickers; a wing basically similar to the piston-engined A. V. Roe Shackleton coastal reconnaissance aircraft and the extensive use of well proven components in the aircraft's systems have all helped to slash development time and production cost and to lower maintenance.

Fabrication and testing are dispersed throughout the Hawker-Siddeley group of companies. Responsibility for the fairly extensive redesign and manufacturer of the wing, and proving tests on a complete wing, boom and tail assembly were assigned to A. V. Roe Ltd. The Gloster Aircraft Co. undertook detail design of tail plane and double slotted flaps.



RANGE variations for AW 650 altitudes, weights and speeds are shown above.

Comprehensive test program includes a programmed fatigue loading of one complete production aircraft and the static testing to destruction of another.

Structural interest centers on stringer-frame joints, fuselage to wing, and tail to boom attachment details, and the subtle use of redux bonding both in fatigue prone areas to implement crack stopping measures, and as a means of building up complex components.

In the fuselage the stringers are completely broken at the frames (spaced at 21 in.), the frame booms running continuously without slotting or stepping. Finger plates sandwiched between frames and skin help as peripheral crack stoppers by offering an alternative load path. Although the stringers are completely broken, continuity is established by riveting the stringer web to the frame web by a small cleat, and by joining the inner flanges by a strap which passes through a hole in the frame web. Stringers are flush with the skin. Effectiveness of this type of joint has been demonstrated in recent tests, ac-

CABLE and WIRE LEADS

by HOWARD E. PENDERGAST
Technical Director, Rex Corporation

Designing the correct multi-conductor cable

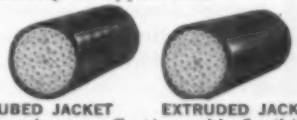
Achieving the ideal combination of flexibility, reliability and cost in multi-conductor cables is a constant challenge to designers.

Over-engineering is surprisingly common, especially in applications where flexibility and weight are vital factors. One cause of expensive over-design is the habit of specifying standard materials listed under general-purpose military specifications. Another is the cable manufacturer's misunderstanding of detailed construction requirements. Numerous instances can be cited where the end user included safety factors in his specifications and the fabricator added more. . . . a practice known to reach ridiculous and extravagant proportions.

Flexibility vs. Cost. A flexible cable, of course, demands flexible stranding for conductors. These, in turn, must be laid up with a tight lay for further flexibility. How tight? If too tight, cabling speed is decreased and material costs rise. A general rule calls for lay of conductors to be five to eight times diameter of unjacketed cable.

Flexibility vs. Reliabilty. The cable's outer jacket is an important factor. It may be applied either tightly or loosely. A tightly applied or extruded jacket has a smooth outer surface and an inner surface that fills the cable core interstices. This not only creates an attractive appearance but also reduces the possibility of conductor transposition and moisture seepage. However, it results in a less flexible cable than one with a loose jacket.

A loose, tubed jacket gives the layers of cable room to move with respect to each other for maximum flexibility. However, because of its looseness it can not match the extruded jacket in reliability or appearance.



TUBED JACKET EXTRUDED JACKET

Other factors affecting cable flexibility include the stiffness of the primary insulating material, the angle of braid and the use of tapes in cable design.

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cording to David Woodley, assistant chief designer. It also simplifies and cheapens fabrication.

Redux floor panels are supported on tubular Warren trusses at the frames.

Modifications to the Shackleton wing arose principally from different engine spacings and greatly increased reinforcement of the Warren and Pratt trusses at boom attachment points, where nodding and boom loads coincide. However, extensive use is being made of existing wing jigs and much of the fatigue data remains applicable.

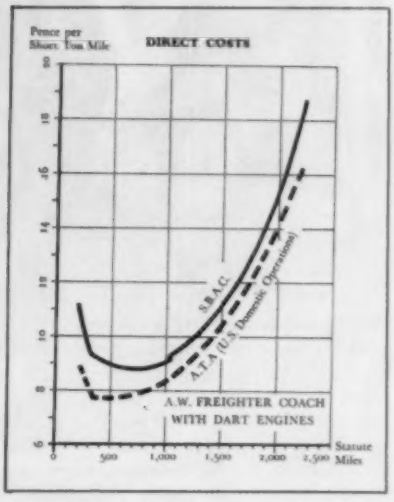
Redux doublers are used extensively sively in areas where fatigue and complex load situations exist. Notable is the use of twin plates bonded together to form the webs in the tail plane box spar. This spar and the tail booms constitute a portal frame in planform and the spar skin is stiffened by bonded spanwise stringers.

Redux bonding is used fairly extenat cut-outs and windows. The freight doors which were one of the major engineering problems in the design have bonded sandwiched bulkheads as stiffeners. Deflection of these relatively large assemblies which have to be hinged on one side only, complicates the closure and sealing problems. Maximum load on the doors when pressurized amounts to 80 tons. A special indexing mechanism automatically lifts the door as it closes on the fuselage in order to cancel the droop and allow the sequenced hydraulic latches, peripherally distributed, to engage.

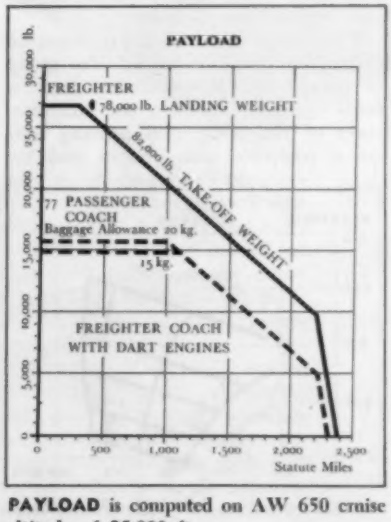
Examples of the use of bonded laminates as means of building up relatively complexed components, are the cockpit floor beam joints, which are pin-jointed to the frames. This method is cheaper and quicker than that possible by orthodox metal forming techniques and is claimed to give better fatigue life.

Bonding is also used to graduate the frame web thicknesses in the region of the floor line. Pressurization stresses are particularly high in this region due to the low position of the floor and its restraint against fuselage expansion.

Some of the fuselage attachment details were described as unique, by A. J. Troughton, chief structural and mechanical engineer. Design is said to



DIRECT operating cost curves have been based on annual utilization of 3,000 hr.



PAYLOAD is computed on AW 650 cruise altitude of 25,000 ft.

Needling A Cylinder To Save Oil

This Airwork Inspector is electronically checking the surface finish on a cylinder wall with a profilometer. This device registers the microscopic roughness of the cylinder walls—an important factor in controlling oil consumption throughout the life of the engine.

Too rough a surface quickly wears the piston rings. Too smooth a surface keeps the piston rings from seating properly.

It takes modern methods to measure cylinder wall finish—and determine when it has been lapped to the exact degree that best controls oil consumption. This test is one of Airwork's 27 precision cylinder rework operations. Together they produce a cylinder that controls oil consumption and conserves power during the life of the engine.

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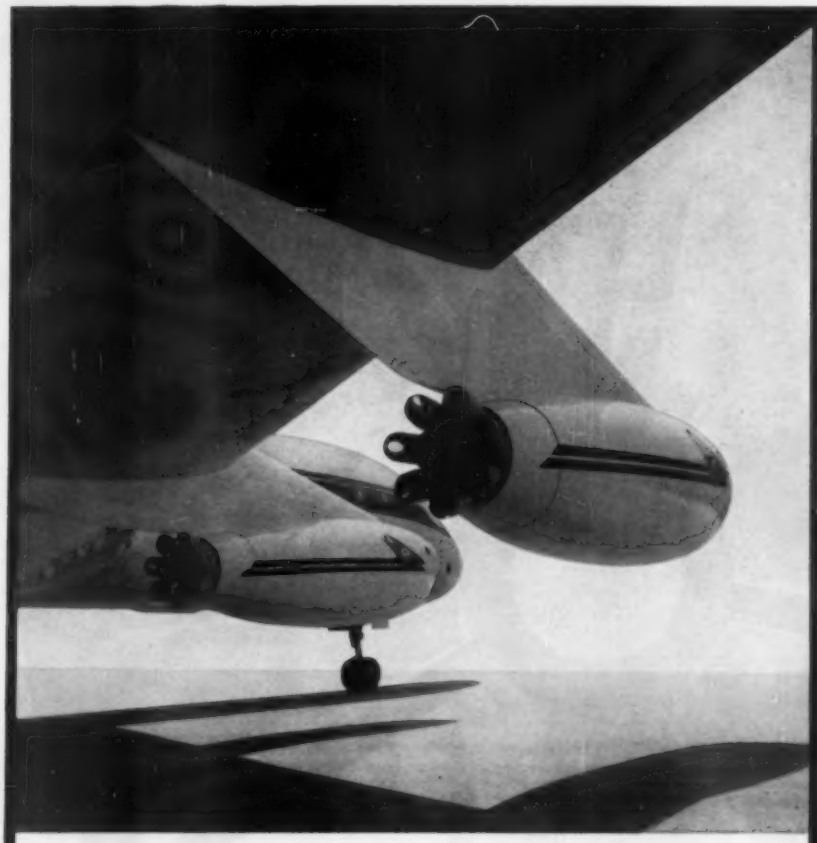

Why the Firebee is America's most used jet drone missile

Ryan Firebees are the most realistic stand-ins for "enemy" aircraft that have ever been developed. Today they're flying longer, farther, higher, and faster on target missions, and more of them live to fly another day. For example: the Air Force recently launched 44 Firebees *in a row* which averaged one hour's flight duration each. And 39 of these—many after target "hits"—were recovered for re-use!

Firebees were the *only targets* used in the Air Force's recent Project William Tell Weapons Meet to evaluate the combat readiness of America's air defense system.

The Ryan role in jet transport

RYAN'S role is to engineer and build better power packs, better airframes, better navigation systems—for the aircraft and engine companies that build America's jet planes.

For the Douglas DC-8, Ryan is building huge, precision-made pods and pylons to harness and package the jet power that gives this jetliner its superb performance.

For the Boeing KC-135 jet tanker-transport, Ryan manufactures mammoth 40-foot-long fuselage sections—the first double-contoured aircraft structures to be spotwelded under automatic production methods. This technique, developed by Ryan engineers, provides an aerodynamically smooth structure, fabricated by weightless methods, that resists metal fatigue at jet speeds and pressurization for extreme altitudes.

To meet the needs of global jet flight, Ryan has developed the lightest, simplest, most reliable, most compact Doppler radar navigators. Now in production for military use, these advanced systems will bring unprecedented precision to commercial jet navigation.

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Argosy Basic Data

Span	115 ft.
Length	86 ft. 9 in.
Height	27 ft.
Wing area	1,458 sq. ft.
Fuselage length	60 ft. 7 in.
Freight cabin volume (gross)	3,680 cu. ft.
(usable)	2,630 cu. ft.
Freight floor area (gross)	426 sq. ft
Freight floor length	46 ft. 8 in.
Freight floor width	10 ft.
Freight floor sill height	4 ft.
Minimum freight cabin height	6 ft. 8 in.
Minimum dimensions of freight doors:	
Front door width	8 ft. 4 in.
Front door height	6 ft. 8 in.
Rear door width	8 ft. 8 in.
Rear door height	6 ft. 8 in.
Seating capacity, seat pitch 34 in.	77
Fuel capacity	3,960 U. S. gal.
Water-methanol capacity	196 U. S. gal.

have considerably lowered the maximum stress levels in the two double frames which transfer the fuselage load to the wing spars.

Each double frame is broken at the wing spar and is attached to it at four points.

The ends of the U section formed are pinned at the neutral axes of the spar the other two connections being effected by swinging links. Supported in this way, each frame acts as a curved beam with pinned ends, the two reactions at each end forming a restraining couple. This couple evens out the stresses and compared with any other method of frame attachment, lowers the maximum stress values.

Wing Flexure

Mounting the frame ends at the wing neutral axis minimizes loads transferred to the fuselage due to wing flexure. If attached at any other position on the wing the distance between the two frame ends would change with stress changes in the spar which would effect the loading in the frame. Changes in the distance between the two wing attachments at each end of the frame due to wing flexure are accommodated by the swinging link. The arrangement has the advantage also of accommodating frame growth, when pressurized, with the least stress penalty, and the ability to attach the swinging links with the widest separation also leads to the most favorable stress distribution in the frame.

Twin horizontal drag links take the horizontal fuselage reaction and the

Alone, out in space, the vast, lonely void can produce abnormal sensations in man. He may experience hallucinations, become strangely exhilarated – or suffer depression deep enough to paralyze the will.

It is the impact of this alien environment on the mind, and on the body, which must be studied before the world can safely follow into space.

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A pilot's psychological state, too, may be determined through measurement. Electrodes taped to insteps measure galvanic skin resistance which reacts to slightest change in nervous structure. Consequent wave form is relayed to earth, helps indicate reaction of passenger to his environment.

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- ▶ Each cable is inspected and tested at every stage of the fabrication process.
- ▶ Assembly is completed at the plant, under rigid Quality Control surveillance, by highly skilled people. Each cable leaves the plant ready for installation. The variables of field fabrication or assembly are eliminated.
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lateral restraint is provided by the frame to spar web connections.

The tail boom configuration forms a portal frame in planform but in elevation the tail plane is pin-jointed to the booms. This is the arrangement used in the Fairchild C-119 design. According to Woodley, as the boom design was based on stiffness considerations rather than strength, fixing the tail plane rigidly in planform added stiffness against fin loads for least weight.

When loaded in this plane the relatively large chord length of the box spar becomes the effective depth of the section.

Pinning the tail plane to the booms in elevation allows the booms to deflect independently in the vertical plane and allows the tail plane to deflect under airloads without forcing the fins to toe-in. In the Nord Noratlas packet aircraft, the tail plane is pin-jointed in both planes and makes no structural contribution.

Thickest plate is used on the tail booms (14 s.w.g.) to ensure slow crack propagation. Wing and fuselage gages are 17 to 21 s.w.g. Snap head riveting on the fuselage was chosen because of the greater ease of production and less surface damage.

Rig test on the undercarriage system provided for full fall under an 0.8G loading. The leg falls forward against the air drag load and is positively locked by a piston which is spring loaded during retraction. It reserves its effort for the last few degrees of downward leg movement. Forward falling geometry was fixed by the need to retract into booms.

Destruction Tests

The company's early advocacy of destructive static and fatigue testing programs for pressurized aircraft was first demonstrated in 1949, when a complete Mamba-engined Apollo airliner was fatigue-tested to destruction in a water tank—three years' before the de Havilland Comet first flew. The Argosy test program, now well under way, provides for the destruction of one complete airframe in static tests and climaxes with the programmed fatigue loading of another.

"It is simply no longer good enough just to proof-load one aircraft and sell it afterwards," Woodley emphasized. The company also has designed to a safety load factor of three—not two as is usual—which it maintains is necessary to ensure a safe life of 30,000 hr.

According to Woodley, a destructive test program does more than prove a particular specimen. It materially helps determination of weight growth factors. Data on the Argosy program indicates that the aircraft can be stretched to at least 110,000 lb. with little reinforcement.

Twin booms, large fuselage, and con-

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"George is great . . . right where he is!"

If ever a compliment could cut the ground out from under a man – you just read it. Just make sure your management never says it about you.

Once upon a time, business moved at a slower pace, and people and things were sort of tidily pigeonholed. So many companies were wedded to a single product, a modest plant, simple processing, comfortable competition, family ownership and one-man rule.

Once upon a time, you could be a specialist in a particular part of a particular business, live within narrow walls, and everything was just dandy. No longer! Today, job isolation is stagnation. Companies, products, industries, have cross-bred like crazy. Anybody's business is everybody's business. Being "an expert" is always essential in depth, lacks much in breadth.

Look ahead, read ahead, get ahead. Open up this magazine, and start reading as you never have before. In the past, your eye instinctively has spotted the pages concerned with you and your job, and you've read this material and used it. Now, take the next big step. Read the stories involving other job functions, other men's brand of problems in your field. Get on speaking acquaintance with all the phases and facets of your business – what one McGraw-Hill publisher so aptly calls "Cross-Communication."

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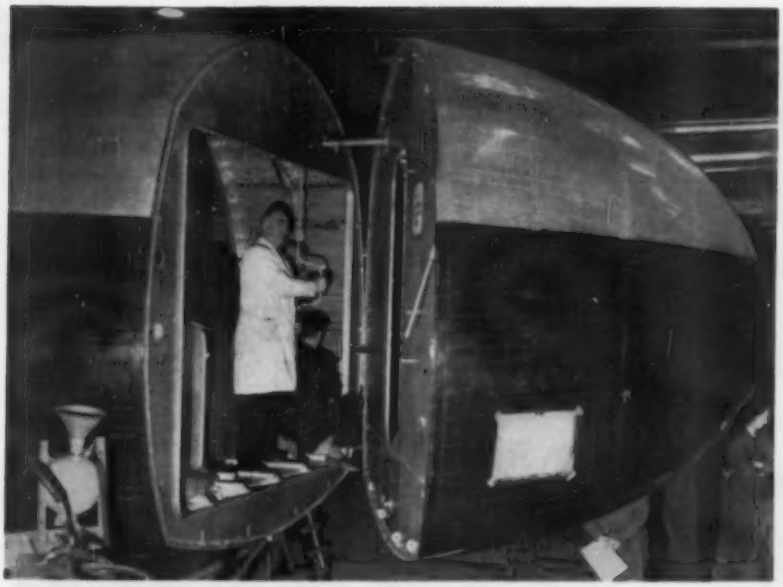

FULL width door is power-operated or can be operated manually (above). Door contains lavatory and a baggage compartment. Latches are sequenced hydraulically.

servative stress levels adopted have involved a slight weight penalty in the current design, Woodley said. But the company was confident that it could reduce the basic operating weight from 56 to 50% of the all-up weight during the development life of the aircraft.

An electronic strain measuring apparatus specially developed for the Argosy program is claimed by the company to be superior to any in existence. It has a capacity of 1,000 channels which can be measured and balanced at the rate of two channels per second. Strain data is automatically fed on punched tape to a Ferranti Pegasus computer for reduction.

First and largest speciman used in the detail test program was a full scale 10 ft. fuselage section. It was used initially to prove the basic stress levels under pressure and floor loading and it was large enough to provide much useful manufacturing experience before production got under way.

Tests were carried out in one of three water tanks and strain was monitored at over 300 stations. The effects of window cutouts and escape hatches were proved in later tests on this specimen and it was finally used to establish crack propagation rates.

Woodley revealed that during the latest tests on this specimen, initiated with a 17 in. crack stretching from one frame, it had taken 1,200 pressurization cycles to extend the crack across the panel and it had failed to propagate into the next panel after a further 2,200 cycles.

Static tests on a complete fuselage, undertaken by Armstrong Whitworth in an externally braced tank 72 ft. long, 20 ft. wide, and 18 ft. high with a capacity of 180,000 gal. of water, commenced Nov. 17. Pressurization, flight and ground loading will proceed to destruction after an extensive survey has been made with strain gages of the general stress distribution to provide data for fatigue life estimations. The tests are particularly notable in providing completely representative floor loadings in pressurized flight.

About 2,000 pressure cycles will be made to prove the fatigue life for the period of the flight development program. Major undertaking is the program fatigue loading of the sixth production aircraft in a water tank basically similar to that used for the static testing but with the addition of cutouts for the wings.

The tests starting next year will include pressurization, flight loads with various flap settings, and undercarriage loads. The loads will be applied directly to the tail plane, wing, fuselage frames, nose wheel structure, engine mountings, flap, flap hinge, ribs, etc.

Four-minute fatigue cycle will simulate a flight plan based on a stage length of 500 naut. mi. cruising at 25,000 ft., and with the application of typical load and gust factors. Fatigue lives for less strenuous fight plans will be extrapolated.

Novel method of determining wear properties of various freight floor panels was to mount specimens in the gangways around the drawing office. This

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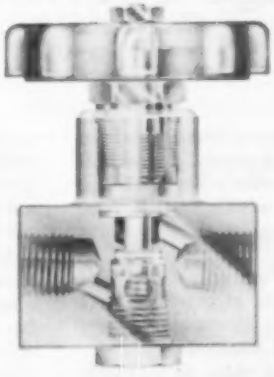

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"SPACE CHESS," a painting by Simpson-Middleman, a doubly-gifted team of artists with a scientist's penetrating insight. They portray here "a chess-like game played in a segment of space on a skewed board with pieces of uncertain value against an unknown antagonist. The next move is unforeseen—it will come out of the dark—it will be history's most fateful gambit."

Space-age openings at Boeing

Advanced projects under contract at Boeing include Minuteman, a solid-propellant intercontinental ballistic missile, and Bomarc, America's longest-range area-defense supersonic guided missile system. Also underway at Boeing are studies for orbital, lunar and interplanetary systems.

These programs, along with extensive advanced research efforts at the frontiers of science, have created some of the nation's truly outstanding career opportunities for engineers and scientists.

There are openings at Boeing, now, in research, design, manufacturing and development, in such advanced areas as celestial mechanics, glide vehicles, space trajectories, high speed drag and heating effects in space flight and re-entry, anti-submarine warfare techniques, gas dynamics, nuclear physics, solid-propellant rocket engines, infrared techniques, anti-missile missiles, advanced electronics, and ion and plasma production and manipulation.

Boeing's space-age orientation, exemplified by advanced studies now underway in ballistic, orbital, lunar, interplanetary and advanced defense systems, has already laid a foundation for continuing leadership in the future. Engineers and scientists of all categories find at Boeing the kind of forward-striding environment that means dynamic career growth. Drop a note now to Mr. Stanley M. Little, Dept. C-83, Boeing Airplane Company, Seattle 24, Washington.

BOEING

system proved the superiority of redux honeycombed sections particularly in behavior of panels after surface damage.

Static test to destruction on a wing-tail booms-tail plane assembly is also well under way. This assembly is rigged with control circuits and surfaces so that the behavior of the control systems in a fully deflected structure could be examined.

The production schedule was based on operator learning curves which predicted a labor content of 20 man hours per lb. of structure. The fabrication cycle of 22 months for the first aircraft is expected to fall fairly rapidly to one of twelve months.

Important feature of the company's production philosophy is the extensive use of short life committees which it is claimed improved the control and communication and speeded decisions. These included a factory layout committee which made extensive use of scale models of the Baginton, Whitley and two Bitteswell factories complete with models of every machine tool and jig. Plastic overlays were used to show alternative production setups.

Center Established For Research Data

Washington—Possibility of improving methods of disseminating the world's growing flood of scientific literature were discussed here last week by experts from 24 nations.

Fact that scientific publication is increasing so rapidly that it is almost impossible to keep abreast of even one field was a unanimous concern at the International Conference on Scientific Information, the first such conference to be held for nine years.

Two major questions were argued at the conference:

- **What agencies should collect** catalog and disseminate the information?
- **What methods should be used to** catalog, store and retrieve the information?

The U. S. apparently has decided to continue the decentralized system of handling scientific information. During the conference, the National Science Foundation and the National Bureau of Standards announced the establishment of a Research Information Center and an Advisory Service on Information Processing is designed to foster closer relations between the government and educational and industrial agencies which handle large volumes of information.

A. I. Mikhailov, a Russian delegate to the conference, explained the centralized system of handling technical information that the Soviet Union has had in operation since 1952. Under this system, one central agency has the

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The Columbus Division of North American Aviation is expanding its electronic staff in the Advanced Design, Systems Management, and Systems Research Groups. Career positions available:

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If you have a problem concerning high-heat protection of metal surfaces up to 4500°F, our Technical Service Department may be of valuable service to you. This service goes far beyond data sheets and specimens. Without cost or obligation, our engineers will analyze your requirements and make specific recommendations based on certified performance data. If necessary, we will visit your plant to confer with your engineers and study the problem first hand.

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responsibility for "collecting, systematizing and generalizing" all national and international scientific experience.

To accomplish this, the Russian center publishes monthly abstract journals in more than a dozen fields and also prints 48 "Express Information" bulletins a year. It also provides microfilm copies of all material on request and other services are made available by large libraries.

Two broad areas of opinion as to the proper manner of cataloguing, storing and retrieving information were very apparent during the conference. One favored continued reliance on the card systems and manual abstracting methods of the present.

The other advocated exerting greater effort toward the development of machines which can perform library work automatically.

Some computer and language experts believe that mechanical translating machines can be perfected and that these machines could form the heart of mechanical library searching equipment.

Rudimentary equipment of this type is being operated in the laboratory by International Business Machines Corp., and specialists from the company believe the next two years or so will bring great improvement. One IBM machine demonstrated automatically produced abstracts of five of the papers given in connection with the conference.

This machine counts the frequency of use of each word and the manner in which it is clustered in the article. On the basis of this information, it then grades the importance of each sentence in the paper and lists them in the author's words in order of importance.

Comments from those observing the machine in action were generally favorable and, in most cases, opinion was that the machine abstracts were superior to those prepared by the authors.

Saunders-Roe to Build Hiller Rotorcycle

Hiller Rotorcycle will be built in England by Saunders-Roe, Ltd., of Southampton, under a license agreement with Hiller Aircraft Corp. and Henry Boris, of Helicop-Air, of Paris. Boris has sublicensed Saunders-Roe to build the Rotorcycle. First five aircraft will be delivered to U. S. Marine Corps for field evaluation (AW Nov. 3, p. 34).

Philco Group Explores Space Communications

Philco Corp. has established a Space Communication Systems Laboratory within its Government and Industrial Division. Unit, headed by F. X. Rettenmeyer, will be responsible for development of advanced devices.

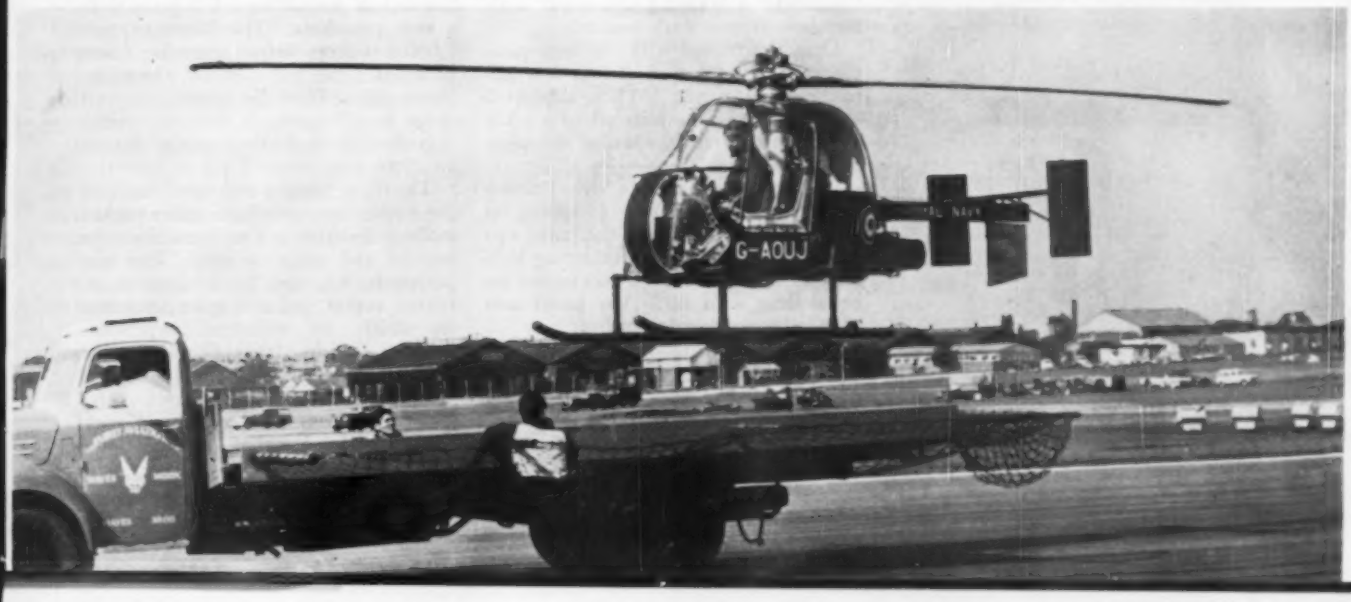
Fairey jet-powered two-place helicopter demonstrates operational capabilities from truck simulating Royal Navy frigate landing platform.

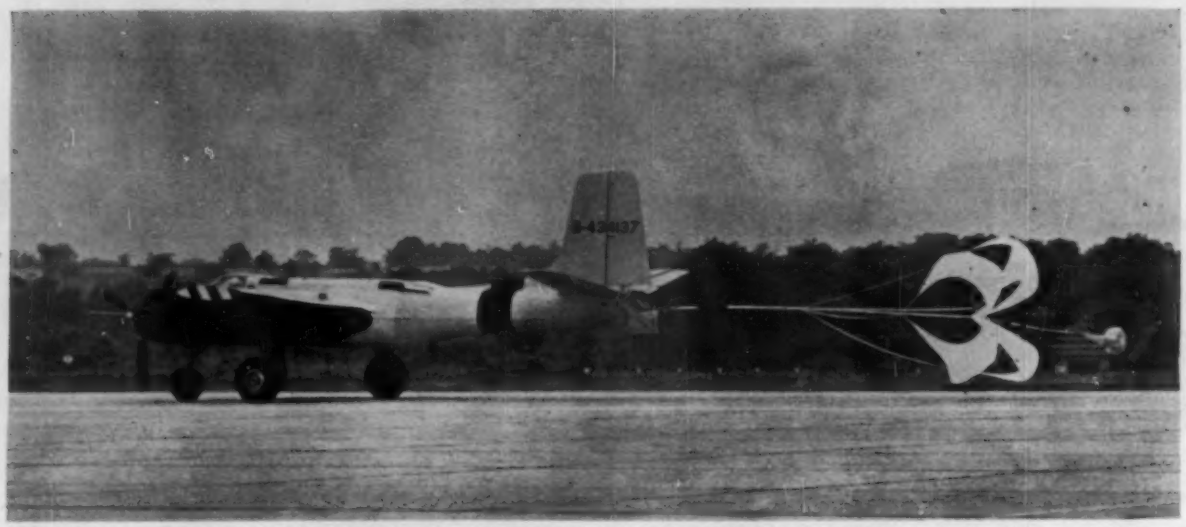
Ultra Light Begins Sea Duty Testing

Fairey two-place Ultra Light helicopter is being developed for eventual reconnaissance work with the Royal Navy, based on frigates. Truck bed is used to simulate exact dimensions of frigate helicopter landing area and truck moves at simulated frigate speed for takeoff and landing demonstrations under operational conditions. Several of this type of helicopter are now in advanced flight testing. Power comes from a Blackburn Palouste air generator supplying air to the rotor tips where additional fuel is burned and the resulting jet is discharged through the nozzles. Noise level is extremely high. Rotating seat allows observer to face forward or aft.

Movable rudder behind jet efflux between fixed vertical stabilizers provides control.

Landing approach on truck bed moving at simulated frigate speed is made by Fairey Ultra Light helicopter. Note handling crew men in nets.





VORTEX ring parachute, rotating in the vertical plane, is evaluated as a drag chute behind a Douglas B-26. In drag chute applications on fighter aircraft, the new chute will effect a 20 lb. weight saving over conventional ground braking parachutes.

Rotating Chutes Planned for B-58, F-105

SPINNAKER-LIKE blades rotate at 30 rpm. as the vortex ring parachute descends with a test load.

New York—Drag chutes for Republic F-105 and the Convair B-58 will be the first application of the vortex ring parachute, a rotating canopy design with one-half the weight and bulk of conventional parachutes with equal drag.

Preliminary tests indicate that the vortex ring chute (AW Dec. 1, p. 35) will offer advantages in other parachute applications including space vehicle and missile recovery and personnel and cargo drop.

The rotating chute was designed by David T. Barish, an aeronautical engineering consultant, with financial backing from Laurance S. Rockefeller. Chute will be produced by the Pioneer Parachute Co., Manchester, Conn., a subsidiary of Reliance Manufacturing Co., under a licensing agreement with Barish.

Drag is achieved with the new parachute by the rotation of four low porosity nylon panels. When deployed, the panels act as airfoils set in a pitch so as to rotate at 30 rpm. as the parachute descends.

This rotation, about a swivel above the harness, achieves drag by setting up a vortex ring of air about the panel tips in the manner of an autorotating helicopter. The parachute is said to provide equal drag with 60% less panel area than a conventional parachute.

Advantages claimed for the rotating chute, in addition to space and weight saving, include lessened opening shock effect, static and dynamic stability, the tendency to fall vertically within an air mass and to collapse itself on landing. Elimination of oscillation, gliding only with the wind and the self-collapsing tendency indicate the design might permit paratrooper drops under wind conditions higher than the present 15 kt. limitation.

Another area in which the vortex ring chute is cited as superior to conventional chutes is that its efficiency is not diminished as the canopy diameter is scaled upward in size as with conventional chutes.

The vortex ring chute is now under evaluation by the Navy, Army and Air Force.

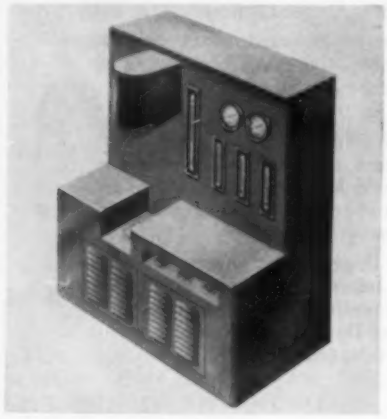
First live jump with the rotating chute will be made in approximately one year. Reason for the delay is the exhaustive testing required by the military before permitting a live jump with a new parachute. The Navy requires 1,000 test drops before accepting a new parachute, the last 250 of which are live jumps. Thus far, some 300 test drops have been made with the vortex ring chute under various speed, altitude and load conditions.

The light weight and small bulk of the vortex ring parachute when packed make it desirable as a recovery chute for missiles and space vehicles. The new parachute has not yet undergone extensive rocket sled testing to determine its ability to withstand supersonic speeds. Barish stated however, that his parachute, with its limited panel area, might lessen the shock wave formed in front of conventional parachutes when traveling at supersonic speeds.

NEW AVIATION PRODUCTS

Pneumatic Valve Tester

Test stand is intended for functional tests of low pressure pneumatic valves on commercial aircraft. Maker says that, in addition to other aircraft, test bench will test 73 valves on the Doug-



las DC-8 and 44 valves on the Boeing 707.

Bench accommodates valves from ¼ to 6 in. diameter, provides 26 v.d.c. and 115 v.a.c., 400 cycles single phase.

Paul-Monroe Co., 6430 E. Gage St., Bell Gardens, Calif.

High Strength Aircraft Bolts

High tensile aircraft bolts are designed to provide longer fatigue life or weight saving through the use of fewer bolts and shorter thread lengths. Manufacturer states that a new method of producing screw threads permits bolt to withstand 2 million cycles at standard fatigue loading. Bolt materials are unchanged.

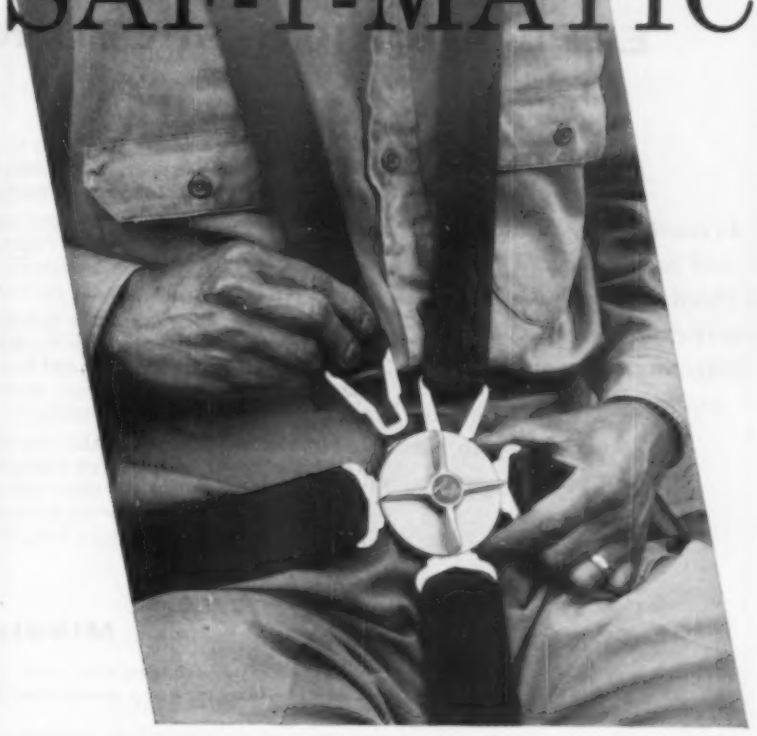
Initial development has been on aircraft bolts in the 180,000 to 220,000 psi. ultimate strength categories. Company tests indicate that improved fatigue strength performance is obtained even in larger (¾ in.) sizes.

Elastic Stop Nut Corp. of America, 2330 Vauxhall Rd., Union, N. J.

Electrostatic Printer

Copytron electrostatic printer is designed to provide fast black and white prints from 35 mm. microfilm. Printer is said to have particular application in

SAF-T-MATIC



the first complete plug-in restraint system...

SAF-T-MATIC is a unique new emergency restraint system especially suited for commercial and private aircraft installation. For the first time both comfort and convenience are incorporated into a single, complete system that provides absolute maximum safety.

The SAF-T-MATIC system consists of Pacific's "Reel-Safe" Shoulder Harness Reel with integral shoulder straps and a specially designed plug-in lap belt and buckle. Combined, these two units allow the user to attach both lap belt and shoulder harness connections in a matter of seconds. Belt adjustment is just a simple pull on the strap ends until the desired snugness is achieved.

When being used, the Reel-Safe allows full freedom of movement – unless an emergency should occur. Only then does the automatic Reel-Safe take over to instantly lock and restrain the user from any force which tends to throw him from the seat – *in any direction!*

The SAF-T-MATIC Buckle has a quick release feature which instantly disconnects both shoulder straps and lap belt fittings by an easy turn of the buckle face in either direction. The user is then free to step from the seat, and when not in use the shoulder straps retract smoothly and completely.

Here, at last, is a *complete system* which provides plug-in convenience...full motion comfort... and maximum safety. SAF-T-MATIC is now in production – write for complete information!

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a test load.

mass and to collapse itself on landing.

speeds.

AERO-THERMODYNAMICISTS EXPLORE HIGH-SPEED RE-ENTRY

A report to Engineers and Scientists from Lockheed Missile Systems— where expanding missile programs insure more promising careers

Advanced weapon system technology has brought to the forefront problem areas requiring attention to interaction between aerodynamic and thermodynamic phenomena. Typical of these is the problem of high-speed atmospheric re-entry.

Expanding research and development activities have coincided with acceleration on top priority programs like our Polaris IRBM. At the same time, positions for qualified engineers and scientists have opened up that are unequalled in responsibility or in opportunities for moving ahead.

Positions in **aero-thermodynamics** include such areas as: aerodynamic characteristics of missiles at high Mach numbers; missile and weapon system design analysis; boundary layer and heat transfer analyses in hypersonic flow fields; and calculation of transient structural and equipment temperatures resulting from aerodynamic heating and radiation.

In addition, openings exist at all levels in **Gas Dynamics, Structures, Propulsion, Test Planning and Analysis, Test Operations, Information Processing, Electronics,** and **Systems Integration.** For these and other positions, qualified engineers and scientists are invited to write Research and Development Staff, Dept. 1712, 962 W. El Camino Real, Sunnyvale, California.

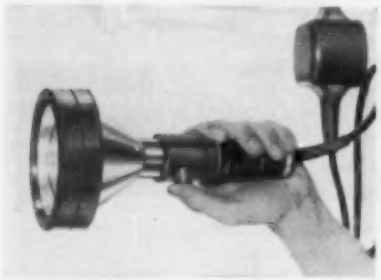
Lockheed / **MISSILE SYSTEMS DIVISION**

SUNNYVALE, PALO ALTO, VAN NUYS, SANTA CRUZ, SANTA MARIA, CALIFORNIA
CAPE CANAVERAL, FLORIDA • ALAMOGORDO, NEW MEXICO

Maurice Tucker, Aero-Thermodynamics Department Manager, right, discusses combined aero-thermodynamic re-entry body tests being conducted in Division's new "hot-shot" wind tunnel. Others are Dr. Jerome L. Fox, Assistant Department Manager, Thermodynamics, left, and Robert L. Nelson, Assistant Department Manager, Aerodynamics.

the aviation industry in printing microfilmed engineering drawings. Printer enlarges microfilm 14 to 16 times and prints the enlargement on standard size sheets from 8½ x 11 to 18 x 24 in.; it can also produce plates for offset printing. Price is $9,750; unit can be leased for about $280 per month.

Charles Bruning Co., Inc., 1800 W. Central Rd., Mount Prospect, Ill.

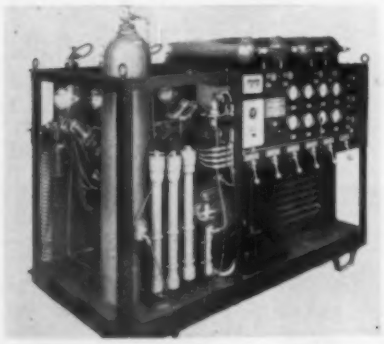


Jet Inspection Light

Light is designed for jet engine and missile inspection. Hand light, sealed in rubber, resists effects of water, fuel, vapors and shocks, the maker says.

Jetlight provides 65,000 candlepower brilliance with GE No. 4515 bulb. Weight is 2 lb. and light is equipped with 65 ft. rubber coated electric cord.

Burton Manufacturing Co., Colorado Ave., Santa Monica, Calif.



Oxygen Compressor

Compressor and transfer unit designed for the Navy is said to pump oxygen 2½ times faster and to 25% higher pressures than former equipment.

Transfer machine holds six 2,250 psi. oxygen supply cylinders and four aviators' breathing cylinders. Unit has a three-stage, four-cylinder, single acting oxygen compressor with a capacity of 10 standard cu. ft. per minute at a reservoir head pressure of 3,000 psi. Water cooled and lubricated, machine is driven by a 220 v.a.c. motor. Compressor pumps into a 3,000 psi. cylinder which has a capacity of 360 cu. ft. of oxygen at 14.7 psia. Unit weighs approximately 1,500 lb. and meets Mil-Spec 0-6705A.

Walter Kidde & Co., Inc., 675 Main St., Belleville, N. J.

Airframe and stress engineers

The Columbus Division of North American Aviation has recently created openings on our Engineering staff for qualified engineers in these fields:

AIRFRAME DESIGN: Capable of designing major complex structural components and assemblies for aircraft or missiles. The ability to integrate weight, stress, loads, and dynamics information into structural layouts is important.

STRESS ENGINEER: An AE or CE graduate with several years in aircraft structures is needed to direct the solution of redundant structural problems by strain energy methods programmed on digital computers. Loads experience or structural flight demonstration analysis helpful.

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North American Aviation, Inc.
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Columbus 16, Ohio

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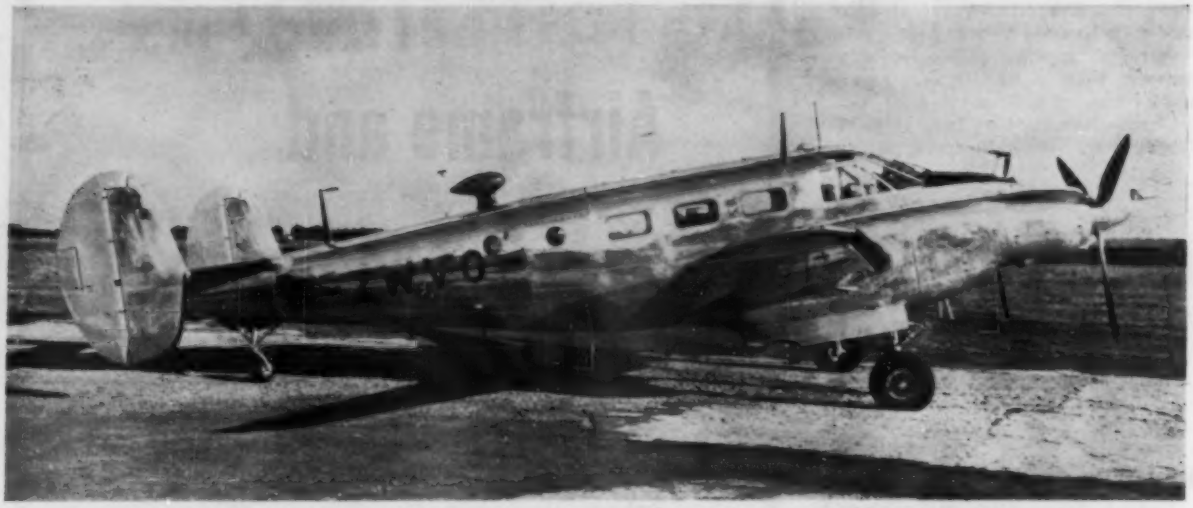


BEECH 18 TESTBED, fitted with Turbomeca Bastan turboprops, has attained 242-kt. speed during trials in France, which are being monitored by Beech engineers. U.S. business plane maker is considering turboprop engines in design studies for future models.

Beech Advance Sales Exceed $10 Million

By Erwin J. Bulban

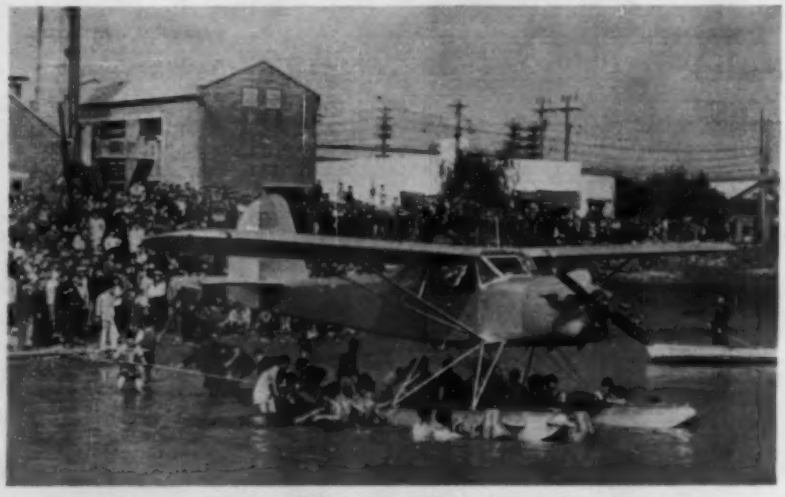
Wichita, Kans.—Beech Aircraft Corp. began its 1959 sales year with firm orders for more than $10 million of new model business planes from its distributor and dealer organization, its initial backlog representing approximately one-third its total executive aircraft sales of $32.1 million last year. Total Fiscal 1958 sales, including military business, were $95.8 million.

More than 350 U.S. and foreign sales representatives attended the company's recent annual distributor-dealer meeting here where 1959 models were previewed. At the conclusion of the meeting, more than $1.5 million of new models were flown away from the factory. Price increases ranging from approximately $15,500 (for Super 18) to $1,000 (Bonanza) were evident throughout the new line.

Main points of 1959 models in the Beech business flying fleet include:

• **Choice of three-blade Hartzell** or two-blade Hamilton Standard propellers on the new Twin Beech Super 18. Use of the Hartzell propellers will permit operating the Twin Beech at a gross weight of 9,700 lb. compared with 9,300 lb. for the Hamilton Standard equipped airplane. Performance of both types is similar within a few miles per hour. The company expects official Civil Aeronautics Administration approval of the new installation in mid-December. Factory installation of the three-blade Hartzell equipment follows numerous private installations in the course of modification programs carried out on various model Twin Beechcrafts at executive aircraft service centers. Additional 1959 features of the Super 18 are: Cagle brake with spring tension units providing automatic release for improved ground handling and taxiing and preventing brake drag on takeoff, two new external carburetor ram air scoops, utility light that can be directed onto wing leading edges to check for ice formation at night, nickel-cadmium long-life battery for starting, dual fuel pump on heater for greater reliability. Basic price of 1959 Super 18 is $122,500, compared with $106,975 for last year's model.

• **Fuel injection-type engines** are the main feature of the G50 Twin-Bonanza executive plane (AW Nov. 24, p. 115). New Lycoming IGSO-480-A1A6 geared



Communist Chinese Test Lightplane

This four-place twin-float civil lightplane reportedly was built in only 48 days at Feilung Machine Building Plant, Shanghai. Powerplant is a five-cylinder radial engine of unspecified horsepower, each cylinder head being individually faired for minimum drag. Propeller appears to be constant-speed type. Feilung No. 1, as lightplane is designated, is reported by Communist sources to take off in 500-650 ft. and is designed to operate from canal networks in rural areas of Communist China. Plane is derived from Russian Yak-14.

and supercharged 340-hp. engines have Simmonds Type 570 continuous flow fuel injectors eliminating carburetors and attendant icing problems, also increase the G50's service ceiling to 28,300 ft. fully loaded and extend nonstop range to 1,720 mi. Gross weight is up 150 lb. to 7,150 lb. Model G50 clears a 50-ft. obstacle in 1,310 fpm. and climbs at 1,320 fpm. New engines and other changes bring the G50 basic price to $92,500. The company also has a lower priced—$80,500—Model D50B Twin-Bonanza available. Like the previous D50A, it has 295-hp. Lycoming high-compression engines. Both 1959 Twin-Bonanzas also have an additional 12-cu.-ft. aft baggage space.

• **New Model 95 light twin Travel Air,** of which close to 200 have been sold since its introduction last year, is basically similar to the previous model. Improvements include five-seat arrangement, providing a folding seat in the baggage compartment. Other changes have been made to ease maintenance: larger access doors on lower cowls of engines provide easier carburetor adjustments and there is an oil access door atop the cowling and lengthened oil filler neck providing access without lifting the cowling. Basic price of the 1959 Travel Air is $51,500, up approximately $2,000 over last year.

• **Model K35 Bonanza** single-engine four-placer features increased standard fuel capacity, with 50-gal. tankage extending nonstop range to 910 mi. Previous standard tankage was 39 gal. If auxiliary tanks are fitted, fuel capacity goes up to 70 gal. and cruise range to 1,245 mi. Other changes include Cagle brakes, new panel layout putting all communications and navigation equipment on the left side, a fifth folding seat in the baggage compartment, redesigned rear seats to provide three inches more leg room and contoured plastic foam seat cushions saving five pounds of weight. Basic price of K35 this year is $25,300, an increase of $1,000.

Sales Awards

Top sales achievement awards this year—providing a seven-day holiday in Hawaii for two—went to Wayne Brown of Combs Aircraft, Inc., Denver, Colo., and R. W. Jeter of Currey Sanders Aircraft Co., Inc., Shreveport, La. In the individual model sales contest, expense-paid four-day vacations in the U. S. for two, went to: Silas King, Flightcraft, Inc., Portland, Ore. (Bonanza); E. G. Box, Cutter-Carr Flying Service, Inc. Albuquerque, N. M. (Travel Air); Ira Hartzog, Butler Airplane Sales, Inc., Chicago, Ill. (Twin-Bonanza); and W. M. Cason, Alamo Aviation, Inc., San Antonio, Tex. (Super 18).

Also honored were 19 domestic distributors for exceeding $1 million sales in airplanes and parts during 1958.

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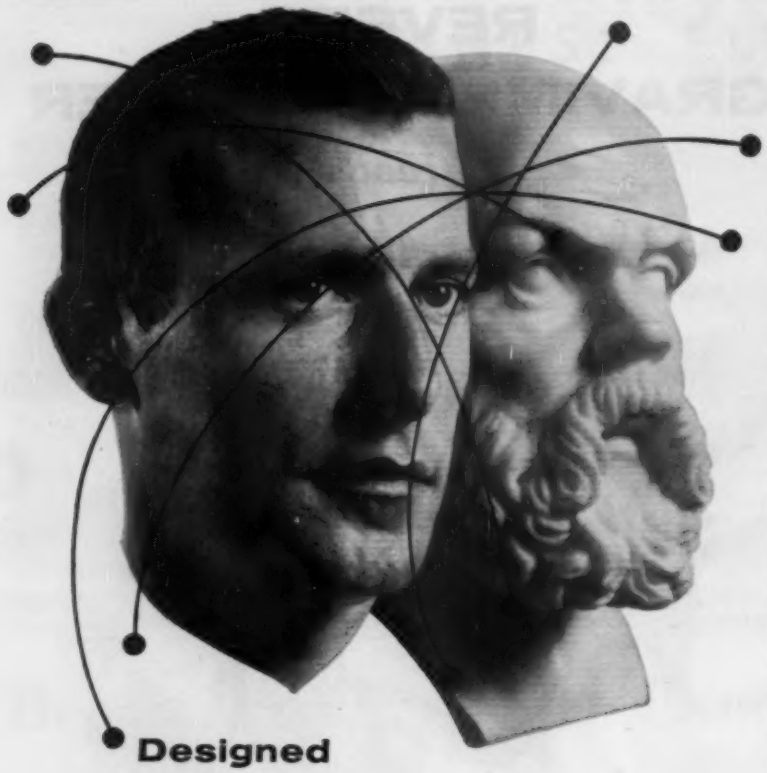

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Bendix Systems Division
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Bendix
AVIATION CORPORATION

WHO'S WHERE

(Continued from page 23)

Changes

Eugene Bollay, director-research, meteorology instrumentation, BJ Electronics, Borg-Warner Corp., Santa Ana, Calif. Also: **Blair Painter**, applications engineering manager.

Harold B. Rose, chief engineer, Cal-Tronics Corp., Los Angeles, Calif.

Edward Victor Lewis, engineering manager, Beattie-Coleman, Inc., Anaheim, Calif.

Thomas L. Brennan, administrative assistant to the vice president of engineering program development, Waste King Technical Products Division, Los Angeles, Calif.

Jess W. Burns, director of technical services, Statham Instruments, Inc., Los Angeles, Calif.

Meyer Leifer, manager, Special Tube Operations, Sylvania Electric Products, Inc., Mountain View, Calif. Also: **Dr. Rudolf G. E. Hutter**, chief engineer, Special Tube Operations, and manager of the Microwave Components Laboratories.

James LeGette, manager, Sprague Electric Co.'s Interference Control Laboratory, Los Angeles, Calif.

David Downey, assistant manager-domestic commercial sales, Convair Division of General Dynamics Corp., San Diego, Calif.

Fred M. Cameron, Jr., chief engineer, Power Sources, Inc., Burlington, Mass.

Kenneth B. Bingham, reliability manager, Long Beach Division, Douglas Aircraft Co., Santa Monica, Calif.

William W. Bumpus, manager, Consolidated Electrodynamics Corp.'s newly-established government liaison office, Washington, D. C.

Frank E. Greene, manager of marketing, Airborne Systems Dept., Defense Electronic Products, Radio Corporation of America, Camden, N. J.

Kenneth J. McDonald, manager-commercial aircraft sales, Canadair Ltd., Montreal, Canada.

Bryon L. Sadler, sales manager, Rosemount Engineering Co., Minneapolis, Minn.

Col. Robert E. Jarmon (USAF, ret.), assistant to the president, Allied Research Associates, Inc., Boston, Mass.

Charles J. Adolph, Jr., assistant sales manager, Kollsman Instrument Corp., Elmhurst, N. Y. Also: **Cmdr. John C. Hebron** (USN, ret.), manager-commercial sales; **Col. G. B. Robbins** (USAFR), manager-engineering services division.

Dr. Arthur L. Aden, director of the newly-formed Solid State Electronics Dept., Military Electronics Division, Motorola, Inc., Phoenix, Ariz.

James T. Thorp, Jr., chief engineer, Lambert Engineering Co., St. Louis, Mo. Also: **Jack P. Olevitch**, chief structures engineer; **C. Howard Bischoff**, engineering administrator; **Claude A. Robb**, director-environmental testing facilities.

E. C. Burns, manager of the newly-created Manufacturing Control Division, Beech Aircraft Corp., Wichita, Kan.

Ellis H. Born, director-sales engineering, Denison Engineering Division, American Brake Shoe Co., Columbus, Ohio.

Robert H. Hemmig, Chief, Photography and Optical Recording, Federal Aviation Agency's National Aviation Facilities Experimental Center, Atlantic City, N. J.

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Qualifications: B.S. or Advanced Degree in E.E. or A.E.

INERTIAL GUIDANCE ENGINEER to assume broad project leadership in the planning and control of development projects. Must have 3 to 5 years' experience in servo-mechanisms or development of complex devices for military applications, including 2 years as technical leader of inertial guidance system development. Must have experience in astro-compass, with ability to analyze relationship of inertial equipment with bombing and navigation computer.
Qualifications: B.S. or M.S. in E.E. or Physics.

RADAR ENGINEER to analyze ultimate limits of present techniques and develop new concepts of providing topographical sensors for advanced airborne and space systems; to design airborne radar pulse, microwave and deflection circuitry; to analyze doppler radar systems in order to determine theoretical accuracy and performance limitations.
Qualifications: B.S. or Advanced Degree in E.E. and 3 to 5 years' experience in radar system development, including display equipment and circuits, control consoles, and doppler or search radar design.

CONTROL SYSTEM ANALYST to perform physical and mathematical analyses needed to solve complex inertial control problems with real-time digital computers. Applications in area of bombing-navigation systems, missile systems, special-purpose computer systems such as DDA.
Qualifications: M.S. or Ph.D. in Physics or related fields with strong math minor and up to 2 years' experience.

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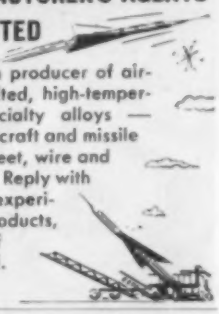

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Major mining concern in northern Quebec requires services of licensed mechanic to act as flight engineer cabin attendant on corporate aircraft. Forward complete resume and photograph.

P-9421, Aviation Week
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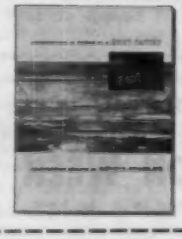

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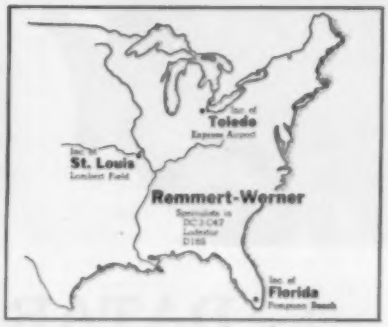

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THE LOS ANGELES DIVISION OF
NORTH AMERICAN AVIATION, INC.

LETTERS

'Obvious' Slip

At the National Symposium on Extended Range and Space Communications, I presented a paper on "Optimum Frequencies for Space Vehicle Communication."

I received letters and long distance calls from interested readers of your publication referring to p. 88 of the Oct. 20 issue (reporting on the symposium) about an obvious misquotation . . . (Discussing radar echoes from the aurorae, the article reported, "Echoes were also detected at 800 mc., with Doppler shifts as great as several hundred megacycles"). Substitute the word "cycles" for "megacycles" and the statement is correct.

SOL PERLMAN
Long Branch, N. J.

(AVIATION WEEK's Avionics Editor, apparently blinded by the Northern Lights, agrees that a Doppler shift of several hundred megacycles at an operating frequency of 800 mc. is an "obvious" slip.—Ed.)

Cold Logic

During the many years that I have been connected with, or interested in, the aviation industry, AVIATION WEEK has become very important to me, being both the best informed and presented periodical in the field, and showing a sane and valuable moral flare and consistency.

It is for this reason that I should like to draw your attention to an interesting anomaly in U. S. law which affects the industry. The easiest way to do it is in the form of personal history.

I am an electronics engineer—not a U. S. citizen—with a major interest in aeronautical communications. Two years ago, when I immigrated to the U. S., I found it impossible to find a position in the aircraft industry and assumed that this was due to clearance problems.

Since then, due to the nature of my work, the U. S. Air Force has cleared me for access to classified material up to and including "secret."

Recently I have felt a desire to change both the locale and scope of my work, and have again tried the aeronautical field, only to meet the same resistance as two years ago. An interesting aspect was the vagueness with which "security" reasons were advanced in each and every case. I gathered a clear impression that all personnel people in the field had been warned of aliens, but were not aware of the reasons.

Prompted by some vague hints from an unusually knowledgeable friend, I finally decided to have a closer look at some of the older laws in the field. This evening I, at long last, found the answer to the mystery.

Thirty-two years ago, the 69th Congress, First Session, enacted a law governing various activities of the U. S. Army Air Corps, including procedures for awarding design and construction contracts for aircraft in order to stimulate the progress of military aviation. Section 10(J) of this act provides that aliens employed by contractors for furnishing aircraft, aircraft parts and aeronautical accessories must be prevented from access to plans or specifications, or participation in contract trials unless written consent has been obtained in advance from the Secretary of the Department concerned.

The penalties, by-the-way, are $20,000 or five years, or both—quite stiff for 1926!

The references for the above are:

U. S. Statutes-At-Large. Vol. 44, p. 787.

U. S. Code (1952), Table 10, Para. 310 (J), which specifically mentions that it is assumed that the Secretary of the Air Force is included in the description as "heir" to the Army Air Corps.

Cold logic says that the act should have been suspended by the Security Clearance System which has come into existence since the days when it was enacted. The ridiculous fact is that it has not.

I have on file formal refusals, on citizenry grounds, from seven aircraft firms and one Air Research and Development Command Center.

ENGINEER
Boston, Mass.

Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

First Things First

Perhaps I was unfortunate to have my luggage mislaid twice in 10 days, and by two different airlines, but the resultant irritation and annoyance, not to mention expense, would seem to deserve mention at a time when on all sides one sees millions being spent on jet travel and elaborate airport facilities.

On the first occasion American Airlines left my bags at Idlewild while I was blissfully on my way to Los Angeles; we were reunited 12 hr. after my arrival at Los Angeles. On the second occasion Trans-Canada Air Lines left my bags at Toronto on a flight via there, from Vancouver to Montreal. The bags followed five hours later.

In these few words are wrapped up a great deal of frustration; innumerable telephone calls and the use of taxis—in one instance to go out and pick up the bags to speed the process and in the second because the limousine service had left. Perhaps the airlines would like to know that to the bill I have to add a shave by a barber as my razor was in the mislaid baggage, and after an overnight flight one does not look at one's best—also wasted hours due to lack of business papers.

Might I and, I understand, other paying passengers add a plea for better baggage handling to eliminate this trouble after the bags go through that little door behind the ticket counter? We do not want to spend the flight worrying about the location of the bags from which we may be parted with ever-increasing speed by the new jets.

First things first, please.

PERCY E. CHORLEY
73 Pampisford Road
Purley, Surrey
England

CAA Comment

I wish to refer and call your attention to your editorial in AVIATION WEEK, Oct. 13, p. 21.

Your editorial certainly was "thought provoking," especially to many Civil Aeronautics Administration officials and employes, and certainly pinpoints the "what" of problems which may exist in any organization; however, the editorial comments become conspicuous without the "why." It follows that the "how" and "when" are equally important in injecting vigorous management and leadership into the new Federal Aviation Agency. Many of us who have been in the Civil Aeronautics Administration and its predecessor agencies for many years agree that the "what" does exist. Also, we are cognizant, generally speaking, of "why." It is due to many failing to progress with the advance of aviation who could be referred to as the "manana people." Likewise, much of the deleterious effects by people within the organization upon the rate of progress is due to cliques of newer, as well as older, officials and employes who do not have the qualities of vigorous leadership for the program requirements and imagination. Those who have these qualifications have many times presented worthwhile suggestions and recommendations for consideration, only to have these ideas ignored or placed on ice, without action. You must agree that after months and years of "throttling" of these ideas, that it can become most frustrating.

I am sure that if many of the old guard in high official positions, both regional and departmental at Washington, are chosen as the panel members for selecting likely candidates in the new Federal Aviation Agency, it can result only in some of the old guard remaining in positions which will retard the rapid progress so urgently required of us all in this agency. Therefore, in my opinion, it is mandatory that this selection panel for the purpose of securing vigorous leaders should make an "on-the-spot" survey in all the regions and the Washington office, interrogating those at the lower "doing" level on up through the management and direction levels, so that a true picture may be obtained. The panel should be composed of representative members, both inside and outside of the Civil Aeronautics Administration. If a panel is not established as such, I feel we will be right back where we started with little, if any, improvement in leadership and management techniques. I have been in a management engineering executive position for many years and these situations, cited above, are my personal opinion.

You may gather, in reading this letter, that I have an axe to grind. Not so, I am interested in continuing to work for an organization that will have the opportunity of placing the caliber of men in the positions where they should be that will reflect credit to the United States aviation position throughout the world, instead of having some "little" men rattling around in big jobs.

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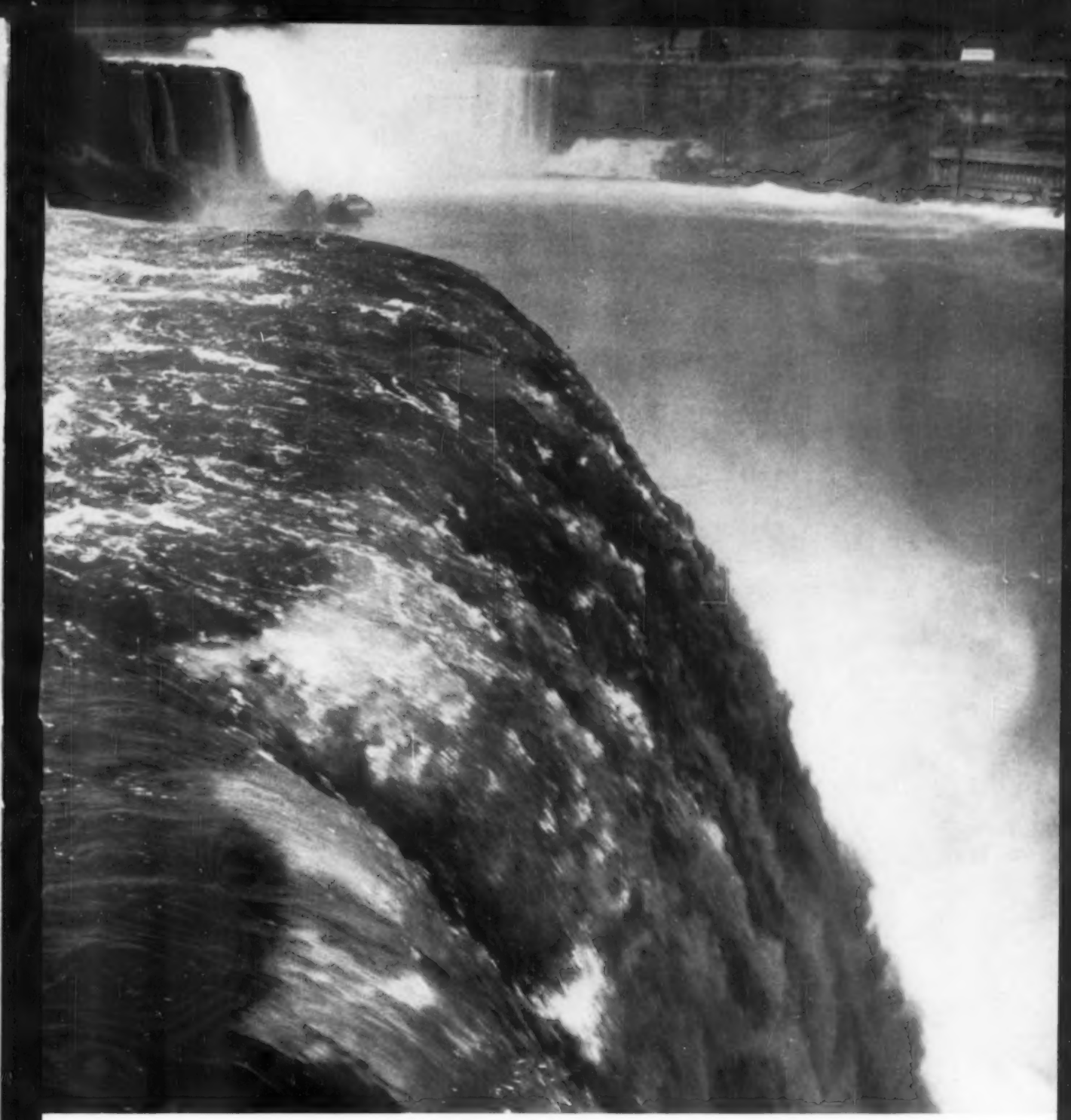
Los Angeles, Calif.



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